CAN ECONOMIC PERCEPTION SURVEYS IMPROVE MACROECONOMIC FORECASTING IN CHILE?*

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I. INTRODUCTION AND BACKGROUND

As in many countries across the world, several economic and statistics institutions in Chile conduct surveys aimed at capturing in near real time the state of the economy and the expectations of its agents. Typically, out of these surveys, one or two synthetic indicators are constructed, to be followed by policymakers and market observers. However, these synthetic indicators may not always reflect a tangible economic expectation or sentiment as they may blend, for instance, expectations about the state of the country's economy in five years' time with the variation of a household's income over the past year. In addition, many short-term forecasting models do not include most of such synthetic indicators because of their alleged lack of explanatory power.[1]

It is important to distinguish between "hard" use, referring to the use of survey indicators in econometric forecasting models, and "soft" use, understood as the use of survey indicators as a way to monitor the economy, along with many other indicators, and for consistency checking model-based projections. Qualitative survey data are mainly used for conjunctural assessment, nowcasting, and short-term forecasting. In order to nowcast and forecast GDP at shorter horizons, many practitioners use three different kinds of models: mixed data sampling models (MIDAS; Ghysels et al., 2007), Bayesian Vector Autoregressions (BVAR; Karlsson, 2013), and *bridge models* (Baffigi et al., 2004).

The use of survey-based expectations for modelling purposes is not a widespread practice among central banks. For instance, the *European Central Bank* (ECB) does not appear to use qualitative, survey-based expectation measures in its

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1 *For the particular case of Chile, see Aguirre and Céspedes (2004) for an example with multivariate dynamic factors, González (2012) using a large-scale Bayesian VAR, González and Rubio (2013) using shrinkage estimators, and Cobb et al. (2011) with bridge models. Some exceptions are Calvo and Ricaurte (2012) making use of one particular question of a survey and, more recently, Riquelme and Riveros (2018) using disaggregated survey indicators to build a coincident indicator of total monthly economic activity.*

models, like the *New Area Wide Model*.[2] However, the ECB regularly mentions the *Business and Consumer Survey*, the *Consensus Economics* surveys and the *Purchasing Managers Surveys* in their monthly reports.

The aim of this document is threefold: i) to assess the quality of the data gathered by the main Chilean qualitative public opinion surveys, ii) to review how they are currently built, and iii) to determine whether differently constructed alternative measures can improve the short-term forecast of macroeconomic variables (i.e. consumption, employment, and investment) when used in conjunction with traditional forecasting statistical models. We also analyze the extent to which action indicators reflect actual investment, hiring, and consumption decisions made by the respondents, an exercise driven by data availability.

It should be noted that, to achieve the goal of capturing the state of the economy, surveys can ask *qualitative* or *quantitative* questions (e.g. "Do you think the state of the economy has improved, stayed the same, or deteriorated over the last year?" versus "What do you think will be the year-on-year rate of CPI inflation for this quarter?"). It is generally believed that qualitative questions, while less precise, are better understood by a non-expert audience and thus better reflect their true sentiment, as opposed to a random guess.

This paper is focused on qualitative surveys only. We are referring to *economic perception or sentiment* indicators, rather than expectations, forecasts, or uncertainty. The Cambridge Dictionary defines sentiment as "a thought, opinion, or idea based on a feeling about a situation, or a way of thinking about something." When applied to economics jargon, this must be understood as economic agents' opinion on future relevant economic developments that may be influenced with actions today; similar to the definition used in Nowzohour and Stracca (2017). This is different to an *economic expectation*, in which agents state their most expected value on a particular targeted variable (e.g. inflation expectation).[3] Moreover, as expectations target a variable, no clear statement is required on the way that value could be achieved; rather it is obtained as the most probable value that a variable could take in the future. As so, the expectation could be computed as the probability-weighted set of *forecasts*. Finally, *economic uncertainty* indicators could be easily understood as the dispersion of those forecasts comprising an expectation.[4]

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2 Instead, such dynamic stochastic general equilibrium models are rather used for long-term forecasting.

3 Note that central banks also run surveys with quantitative questions on future values of key indicators like Chile's Economic Expectations Survey (EEE) and Financial Brokers Survey (EOF).

4 Another related indicator is the Purchasing Managers' Index (PMI). The PMI is a manufacturing-sector indicator based on a survey applied to companies' decision makers, analysts, and purchasing managers, comprising new orders, inventory levels, production, supplier deliveries, and the employment level. As mentioned above, the PMI is not related to an economic sentiment indicator. As will be reviewed later, the PMI measures a subset of the indicators used in this article; also sharing the criticism of putting together information that may be useful at a disaggregate level.

We try to overcome the limitations of the existing synthetic indicators by suggesting eight alternative measures that draw from subsets of questions included in the surveys. In particular, we distinguish between *current sentiment* and *future expectations* as well as between *personal* and *country-wide* measures.

The results suggest that there is not a strong relation between *personal* and *country-wide* alternative indicators, and indicators about the future consistently seem to lead corresponding current-situation indicators. In addition, a Granger causality analysis across surveys does not bring significant results, meaning that indicators are more often than not independently constructed. Hence, for the same economic phenomena, different appraisals are obtained depending on the consulted survey. This is analyzed in terms of survey representativeness and other dimensions.

Also, a multistep out-of-sample exercise is conducted to compare the predictive gains of using the newly proposed measures versus the existing indicators. In particular, we forecast *private consumption*, plus its two components (*non-durable* and *durable*), making use of the measures constructed using consumer expectations surveys, and compare them to the existing indicator and the no-indicator-augmentation cases. Similarly, we forecast investment (*gross fixed capital formation*, *machinery and equipment*, and *construction and works*) making use of the measures from business surveys. Finally, a similar exercise for *total employment* is also conducted.

Our predictive results reveal the usefulness of our proposed alternative measures. This is mostly shown for the case of total and non-durable consumption, particularly at the larger horizons considered, using the *country-wide current* measure and the *personal future* measure, where major and significant predictive gains are noticed. Regarding investment, predictive gains—yet non-significant—are found with the existing synthetic aggregate indicator for total investment and its two components; a secondary role is found for the *overall* (*country* and *personal*) *current sentiment* measure when forecasting *aggregate investment* and *construction and works* at longer horizons. Hence, business surveys do not necessarily describe the investment dynamics within our general econometric framework. We also find that, in general, hiring plans and investment actions are caused mainly by the country's future situation indicator. In turn, the actions cause, in general, personal situation indicators at both current and future horizons.

The remainder of the article proceeds as follows. Section 2 gives an overview of the different Chilean public opinion surveys and analyzes in more depth five of them. Section 3 constructs and analyzes new alternative measures from the five mentioned surveys. In section 4, an empirical exercise is conducted, aimed at identifying the forecasting power of newly proposed alternative measures as well as the extent to which macroaggregates are related to action indicators. Section 5 concludes and suggests directions for future work.

II. ECONOMIC PERCEPTION SURVEYS IN CHILE: BASIC OVERVIEW

1. Main surveys

Three distinct types of organizations conduct public opinion surveys that are aimed at or contain questions on economic perceptions in Chile: universities (*Centro de Microdatos*—Universidad de Chile, Universidad Adolfo Ibáñez [UAI], and Universidad del Desarrollo), non-governmental organizations and public companies (Cadem, *Centro de Estudios Públicos* [CEP], and *Instituto Chileno de Adminstración Racional de Empresas* [Icare]), and private companies (e.g. *Adimark*, *Ipsos*).

In this article, five different surveys are scrutinized: i) the monthly index of business confidence elaborated by Icare-UAI (hereafter, IMCE), ii) the economic perception index elaborated by *Adimark* (IPEC), iii) the survey on economic perceptions and expectations elaborated by *Centro de Microdatos*, University of Chile (UChile), iv) the index elaborated by the *Centro de Estudios Públicos* (CEP), and v) the marketing-research company Cadem's "*Plaza Pública*" survey ("*Public Square*" (Cadem).[5]

2. Methodological features

Data representativeness

From table 1, we can see that all surveys use robust statistical methods to make sure the target universe is well represented. However, this sometimes represents only a fraction of the Chilean population or the economy. For instance, the IMCE focuses on only four sectors (mining, manufacturing, construction, and commerce[6]) and ignores services, which accounts for a large percentage of Chilean GDP (close to 39% using the 2013-2016 average). In the same vein, the UChile survey focuses on the Santiago area, which only accounts for approximately 40% of the overall Chilean population. The IPEC ignores inhabitants without landlines, meaning that it leaves lower-income categories out of the sample.[7] While these are mainly unavoidable due to practical limitations, it is important to bear them in mind when interpreting the indicators resulting from these surveys.

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5 The consumer perception index (Índice de Percepción del Consumidor, IPeCo), the business confidence index (Índice de Confianza Empresarial, ICE), and the private companies' data are left for further research as they require special treatment due to sampling and timing concerns. Regarding private companies, there are five different conducting generalist consumer market-related surveys in Chile: Adimark/GfK–conducting the monthly IPEC; Ipsos; Kantar Ibope Media–conducting the half-yearly Target Index Group; Mori; and Nielsen–conducting the half-yearly consumer confidence, and spending intention report. Apart from Adimark, their data are not freely available to the public and are gathered for marketing purposes.

6 Wholesale and retail trade.

7 In this regard, it is worth noting that top international surveys, such as the University of Michigan's Survey of Consumers or the European Consumer Surveys have gradually switched to mobile phone registers to better penetrate the population.

Table 1

Data representativeness description for the five public opinion surveys analyzed

Survey	IMCE	IPEC	UChile	CEP	Cadem
Institution	Icare	Adimark	Centro de Microdatos - Universidad de Chile	Centro de Estudios Públicos	Cadem Plaza Pública
Universe	Private companies in the trade, construction, manufacturing, and mining sectors. These sectors account for 38% of GDP (2015)	Inhabitants over 18 living in a dwelling with a landline	Inhabitants over 14 living in the Santiago Metropolitan Region and in Puente Alto and San Bernardo - about 40% of Chilean population in 2013	Inhabitants over 18	Inhabitants over 18 living in one of the 73 cities with more than 50,000 inhabitants (71% of Chilean population, 2014)
Sample	611 businesses (200 in trade, 100 in construction, 300 in manufacturing, 11 in mining)	Approximately 1,000 individuals	3,060 households	About 1,450 individuals	710 individuals
Sample method	Panel	Stratified random sampling	Stratified random sampling, with some panel data component	Stratified random sampling	Stratified random sampling
Collection technique	Email	Phone calls	Face-to-face interview	Face-to-face interview	Telephone and face-to-face
Answer rate	100%	Unknown	77.4% (March 2014)	77% (November 2015)	Unknown
Representativeness with respect to universe	Good, assuming businesses account for a large part of their sectors	Good, although there is a bias toward older people (mobile phone call would greatly enhance representativity)	Very good	Very good	Very good
Overall representativeness (Chile)	Medium - adding transport and financial, personnal and dwelling services in the universe would raise its representativity to 79% of GDP (2015)	Good	Medium, as it focuses only on Santiago	Very good	Very good

Source: Authors' calculations.

Frequency and timing

Table 2 compares the frequency of the different surveys and the timing of their questions. As regards frequency, it is important to note that the CEP survey follows no definite pattern, whereas the Cadem survey, although done on a weekly basis, started only in March 2014. Also, most surveys began in the 2000s, but some questions have been included later. Therefore, there is a distinction between the *start date* and the *full data availability date*, which is defined as

the first period in which all the currently asked questions became available.

Table 2

Frequency and timing for the five public opinion surveys analyzed

Survey	IMCE	IPEC	UChile	CEP	Cadem
			Frecuency		
Frequency	Monthly	Monthly	Quarterly	No definite pattern (usually half-yearly)	Weekly
Start date	November 2003	Annual: 1981 Quarterly: 1986 Monthly: 2002	March 2001	March 2000	March 2014
Full data availability date	June 2004	June 2002	March 2001	December 2007	June 13, 2014
			Timing		
12M ago	-	-	Country economy	-	-
3M ago	-	-	Durable good	-	-
Currently	State of business Inventory Sales / activity Demand Utilized capacities Production	Country situation Business situation Personal situation Time to buy Saving	Income Indebtedness	Country situation Personal situation	Country situation Personal situation Time to buy Employment
3M ahead	Country-wide economy Employment Sales Costs and prices Production	-	Durable goods	-	-
6M ahead	Country-wide economy Business situation Investment Wages Financial situation	-	-	-	-
12M ahead	-	Country-wide economy Personal situation Saving Unemployment Inflation	Country-wide economy Inflation Buy house	Country-wide economy Personal situation	-
5Y ahead	-	Country situation	-	-	-

Source: Authors' calculations.

In terms of the time scope of questions, there is a clear difference between the IMCE, which asks shorter-term forward-looking questions (3 to six months) and the other surveys (12 months or 5 years). Except for UChile (and due to the different formulation of its questions), all surveys ask contemporaneous rather than backward-looking questions, even if the answers to contemporaneous questions are evaluated relative to a past situation. It is important to note that the 5-year-ahead question in the IPEC survey is not relevant for our objective of short-term forecasting.

Survey questions

We can categorize the questions asked by each of these surveys into two dimensions. First, the *temporal dimension* distinguishes between questions aimed at capturing a current or backward-looking sentiment and questions aimed at identifying forward-looking expectations ("Is the economic situation of your household better, the same, or worse than one year ago?" versus "In one year, do you think the economic situation of your household will be better, the same or worse than now?") The second dimension discriminates between questions focusing on the *individual agent*, be it households or firms, and *country-wide questions* ("Is the economic situation of your household better, the same, or worse than one year ago?" versus "Is the economic situation of the country better, the same, or worse than one year ago?")

Table 3 presents the number of questions asked by the five surveys across the two dimensions. We can first note that the three specialized surveys on economic perceptions—IMCE, IPEC, and UChile—, ask a total of 16, 14, and 12 questions respectively, whereas CEP and Cadem, which include economic perceptions within a broader opinion survey, only ask 5 and 7 economic-oriented questions. In addition, the IPEC, UChile, and CEP surveys ask at least one question in each of the four sub-categories, whereas IMCE does not ask any country-wide, backward-looking question. More precisely, IMCE and UChile almost exclusively ask personal questions (15 out of 16, and 9 out of 12 respectively), while IPEC mainly focuses on forward-looking questions (11 out of 14), and Cadem focuses on the current situation (6 out of 7). Only the CEP survey is balanced in terms of the number of questions asked by category but with substantially lower frequency.

Table 3

Typology of survey's questions

	Country	Personal	Total
Current and backward-looking	IMCE: 0 IPEC: 2 UChile: 2 CEP: 2 Cadem: 4	IMCE: 6 IPEC: 1 UChile: 4 CEP: 1 Cadem: 2	IMCE: 6 IPEC: 3 UChile: 6 CEP: 3 Cadem: 6
Forward-looking	IMCE: 1 IPEC: 6 UChile: 1 CEP: 1 Cadem: 1	IMCE: 9 IPEC: 5 UChile: 5 CEP: 1 Cadem: 0	IMCE: 10 IPEC: 11 UChile:6 CEP: 2 Cadem: 1
Total	IMCE: 1 IPEC: 8 UChile: 3 CEP: 3 Cadem: 5	IMCE: 15 IPEC: 6 UChile: 9 CEP: 2 Cadem: 2	IMCE: 16 IPEC: 14 UChile: 12 CEP: 5 Cadem: 7

Source: Authors' calculations.

Table 4

Classification of questions per survey*

	IMCE			IPEC		
	General questions	Individual questions	Individual questions requiring action	General questions	Individual questions	Individual questions requiring action
Backward-looking question	-	2. How is the current state of your business?	-	17. How is the current situation of the country? (5 choices)	26. How is the economic situation of your household compared to one year ago?	-
	-	3. How is the state of your inventory? (except construction)	-	18. What is the current situation of businesses? (implied: compared to before)	-	-
	-	4. How did your sales evolve compared to last month? (commerce, industry and mining) How did the activity of your company evolve in the past 3 months? (construction)	-	-	-	-
	-	5. How is the demand faced by your business currently? (construction and mining)	-	-	-	-
	-	6. How has the production of your company evolved compared to last month? (industry and mining)	-	-	-	-
	-	7. What is the percentage of your utilized capacities? (industry and mining)	-	-	-	-
Forward-looking question	1. How will the general economic situation of the country evolve in the next 6 months Commerce)?	8. How will the state of your business evolve in the next 6 months? (except construction)	14. How will the employment in your company evolve in the next 3 months?	20. What will be the economic situation of the country in 12 months? (5 choices)	28. How will the economic situation of your household evolve in the next year?	-
	... In the next 3 months (construction)?	9. How will your sales evolve in the next 3 months? (commerce only)	15. How will the investments of your company evolve in the next 6 months? (except construction)	21. What will be the economic situation of the country in 5 years? (5 choices)	29. What is the probability that you will be able to save money within the next 12 months? (5 choices)	-
	… The economic activity of the country in the next 6 months? (industry and mining)	10. How will the price of your inputs evolve in the next 3 months?	16. How will the average wage in your company evolve in the next 6 months? (except commerce)	22. What is most likely to occur with the economic situation in the next 5 years? (be fine continuously / periods of recessions and high unemployment)	30. Is this a good time to buy a property?	-
	-	11. How will the price of your sales evolve in the next 3 months?	-	23. How will the level of unemployment evolve in the next 12 months?	31. Is this a good time to buy a car?	-
	-	12. How will your financial situation evolve in the next 6 months (commerce)? In the next 3 months (construction)?	-	24. By how much will the prices evolve in the next 12 months? (a lot, a bit)	32. Is this a good time to buy large items?	-
	-	13. How will your production evolve in the next 3 months (industry and mining)?	-	25. Given the actual situations of the country, is it a good time to save?	-	-

Table 4 (continued)

Classification of questions per survey*

	CEP			UChile			Cadem Plaza Pública		
	General questions	Individual questions	Individual questions requiring action	General questions	Individual questions	Individual questions requiring action	General questions	Individual questions	Individual questions requiring action
Backward-looking question	33. How is the current economic situation of the country?	36. How do you qualify your current economic situation?**	-	38. How was the economic situation of the country a year ago? (better, same, worse)	41. How did the income of your household vary in the last 12 months?	45. Did a member of your household buy a durable good in the past 3 months?	48. Taking into account all political, social and economic aspects, do you think the country is on a good or bad trajectory?	53. How would you rate the current economic situation of yourself and your household?	-
	34. Do you think Chile is progressing, stagnating, or in decline?	-	-	39. What are the three main problems of the country?	42. How is the situation of your household in term of indebtedness? (complicated, average, no problem)	45.b If so, how have you financed it? (credit or cash)	49. Do you think that the Chilean economy is progressing, stagnating or declining?	54. How would you rate the economic situation of consumers to purchase goods and services?	-
	-	-	-	-	-	-	50. How would you rate the current economic situation of businesses?	-	-
	-	-	-	-	-	-	51. How would you rate the current situation of employment in the country?	-	-
Forward-looking question	35. How will the economic situation of the country evolve in the next 12 months?	37. In one year, how do you think your economic situation will be compared to today?**	-	40. In one year, how will be the economic situation of the country compared to today?	43. How will the income of your household vary within the next 12 months?	46. Will a member of your household buy a durable good in the next 3 months?	52. In general, how do you feel about the future of the country?	-	-
	-	-	-	-	44. What will be the CPI inflation rate in 12 months?	46.b If so, how will it be financed? (credit or cash)		-	-
	-		-	-	-	47. Are you or a member of your household thinking of buying a house in the next 12 months?		-	-

Source: Authors' calculations.
* Dark beige cells: Questions asked in the formation of existing aggregate indicators. Light beige cells: Questions asked in the formation of new indicators (in addition to existing questions). Unless indicated otherwise, all questions about future or past states are answered in comparison to the current state.
** Those questions are irregularly asked

Table 4 complements table 2 by delving into the precise formulation of the questions. It is important to note that no questions are consistent across surveys: even if they target the same concept or mean the same thing, the wording is not exactly the same, thereby reducing the comparability of the answers across surveys. For instance, in a question about the future economic situation of the country, the wording can vary across many dimensions: the time frame (three months for IMCE questions for the construction sector, six months for the commerce sector or 12 months for the IPEC) or the precise object of the question ("The general economic situation of the country" for IMCE questions aimed at the commerce sector, "the economic activity of the country" for IMCE questions aiming at the manufacturing and mining sectors). In addition, in a question about the current economic situation of the household, the point of comparison can be relative, as in the IPEC ("Better, the same, or worse than one year ago"), or absolute as in the Cadem survey ("Very good, good, bad, or very bad"). Similarly, for questions about past or future consumption, IPEC's wording is general and not targeted at the individual's intention to consume ("Do you think now is a good time to buy a car?") while UChile is more precise ("Do you think you or a member of your family will be buying a car in the next three months?"). However, while the wording is heterogeneous across surveys, it is worth noting that it remains consistent across time within each survey.

Synthetic indicators

It is important to look at the way the different institutions transform the qualitative answers to their questions into quantitative indicators. We must distinguish two steps: the first step consists in aggregating the individual answers to the same question to get a number, called in our case the *balance statistic*, while the second step is to aggregate the balance statistic of each question to form the synthetic indicator.

The methodology used by all surveys for the first step is to compute the balance statistic for each question. Intuitively, the balance statistic is the difference between the percentage of positive answers and the percentage of negative answers. Formally, it is defined as $\textit{balance statistic} = 100\left(\sum_1^n j_i x_i\right)$ where n is the total number of individuals surveyed, j_i is the weight of the i-th sample unit, and x_i is the response of the i-th sample unit, taking value one when the answer is "yes" or "increase", minus one when the answer is "no" or "decrease", and zero when the answer is "stable", or "I don't know". The weight of the i-th sample unit is chosen in such a way that the sample is representative: the weight is inversely proportional to the probability of unit i to be drawn; hence if the sample is random, the weight is simply $1/n$.

To construct their aggregate indicator (step 2) all surveys simply take the average of the balance statistics of the questions composing the indicators. In the case of the IMCE, there is a third step: steps 1 and 2 are done at the sector level only, leading to a sectorial indicator. To construct an economy-wide indicator, *Adimark* (IPEC) weights the sector indicators according to their relative importance in the Chilean GDP. However, it is important to note that

these weights were constructed in 2005 and have not been updated since. While the balance statistic is the easiest and most common way to transform qualitative data into quantitative aggregates (it is used, among others, by the University of Michigan and the *Directorate General for Economic and Financial Affairs* of the European Commission, which conducts the *Business Consumer Survey*), it is not the only possibility, and research shows that this easiness comes at a loss of information.

For instance, a neutral index can either mean a strong disagreement (50% of positive and 50% of negative answers), or a strong neutral feeling (100% of neutral answers). Two main other alternatives (Nardo, 2003) have been developed by academics, namely the Carlson and Parkin (1975) *probability method*, and the Pesaran (1984) *regression approach*; the balance statistic being a special case of the former. Intuitively, the probability method takes a latent variable approach, if agents report a change only when their true expectation is above or below a threshold to be estimated.

The regression approach instead tries to estimate the quantitative value of the underlying qualitative answer by assuming that expectations and realization behave the same way and, in particular, are dependent on the past percentage of people answering positively and negatively. As these different approaches also have their own limitations (linked to strong assumptions), the balance statistic method remains the standard approach among practitioners. While the issue will not be discussed further, one would be advised to check for robustness of results obtained using the balance statistic approach. Importantly, we should note that the balance statistics reported by the organizations conducting the surveys are normalized so that the values lie between 0 and 100 and a neutral indicator is 50.

We turn to the analysis of the existing synthetic indicators. First, note that the Cadem survey does not construct any indicators from its questions and reports them directly. In turn, the IPEC, IMCE, and CEP use less than half of their available questions to construct their indicators, as shown in tables 4 and 5. In addition, the number of different indicators reported by each survey is quite varied. While the IPEC and CEP only report one indicator, the IMCE reports six different ones: one for each sector, an aggregate indicator, and an aggregate indicator minus mining. The idea in this sub-section is to report the same indicator for the different sectors (and considering the peculiarity of the mining sector) rather than to distinguish between the different temporal components of the indicator. Therefore, the fact that IMCE reports a high number of different indicators does not help address the issue raised in this sub-section. On the other hand, the UChile survey reports five indicators, four of them corresponding to one of the cells in table 3; the last one being an aggregate indicator. The UChile indicators fit into the decomposition of questions into two different dimensions made above.

In sum, while not all surveys lead to a single, symmetric indicator, most of them produce composite indicators that combine questions with different focuses and time perspectives. This may seriously compromise the rational meaning and

usefulness of such indicators for economic forecasting.

Table 5

Existing synthetic indicators used for constructing alternative measures

Survey	IMCE	IPEC	UChile	CEP	Cadem
Number of indicators	6 One for each sector, an aggregate, an aggregate without mining	1	5 One aggregate and four sub-indices: Current and expected situation; family and country situation	1	None
Number of questions used	6 out of 16	5 out of 14	8 out of 11	2 out of 5	-
Questions used	Current state of business Current inventory Current demand Future state of business Future production Future employment (construction)	Current country situation Current personal situation Future country situaton (12M) Future country situation (5Y) Time to buy large items	Current country situation Current income Past purchase Indebtedness Future country situation Future income Future purchase (house and items)	Current country situation Future country situation	-

Source: Authors' calculations.

III. DECONSTRUCTION AND DESIGN OF ALTERNATIVE MEASURES

The review of the main surveys of economic perceptions in Chile suggests that despite non-traditional differences in sampling (*i.e.* differences at the same time in the universe, the sample, and collection technique) and questionnaires, they provide a rich set of data that should be helpful in monitoring perceptions that can provide insights into economic performance. The challenge, however, is how to organize such data in order to extract meaningful and robust data for economic forecasting. In this section, we propose a set of measures constructed with the aim of better reflecting particular expectations. They are henceforth referred as "alternative measures", as opposed to the "existing synthetic" or "aggregate" indicators being currently used.

1. Conceptual structure and alternative measures

We now return to the categorization of survey questions across alternative directions. In particular, we consider two dimensions—focus and timeframe—with two alternative states each: *country/personal* and *current/future*, respectively. These give rise to a number of combinations. For instance, one could be interested in knowing the individual's current sentiment about the economic situation of the country, the individual's future expectations of his or her personal situation, or even the overall current sentiment of the country, both at individual and country-wide level. Following this logic, eight new alternative measures can be constructed, as represented in table 6.

Table 6

Schematic representation of the alternative measures across country/personal and current/future dimensions*

Indicator	Country	Personal	Overall
Current	CCSI	PCSI	OCSI
Future	CFEI	PFEI	OFEI
Overall	OCI	OPI	

Source: Authors' calculations.

* The acronyms correspond to: Country Current Sentiment Indicator: CCSI, Personal Current Sentiment Indicator: PCSI, Country Future Expectation Indicator: CFEI, Personal Future Expectation Indicator: PFEI, Overall Future Expectation Indicator: OFEI, Overall Current Sentiment Indicator: OCSI, Overall Country Indicator: OCI, and Overall Personal Indicator: OPI.

The time series for each of these measures are plotted in figure 1. The name of each alternative indicator is chosen so as to make it self-explanatory. The names distinguish between current sentiment and future expectation as well as between personal and country-wide indicators. The alternative measures starting with "Overall" aim at averaging one dimension (*personal*/*country* or *sentiment*/*expectation*) to provide a further indicator for the other dimension. In terms of table 6, all cells have now their own indicators except the lower right-hand cell. This cell would correspond to an "Overall overall" indicator that would make no sense for two reasons: first, it goes against the idea of deconstructing aggregate indicators in order to gain a better insight of one particular dimension; second, this often corresponds to the existing synthetic indicator.

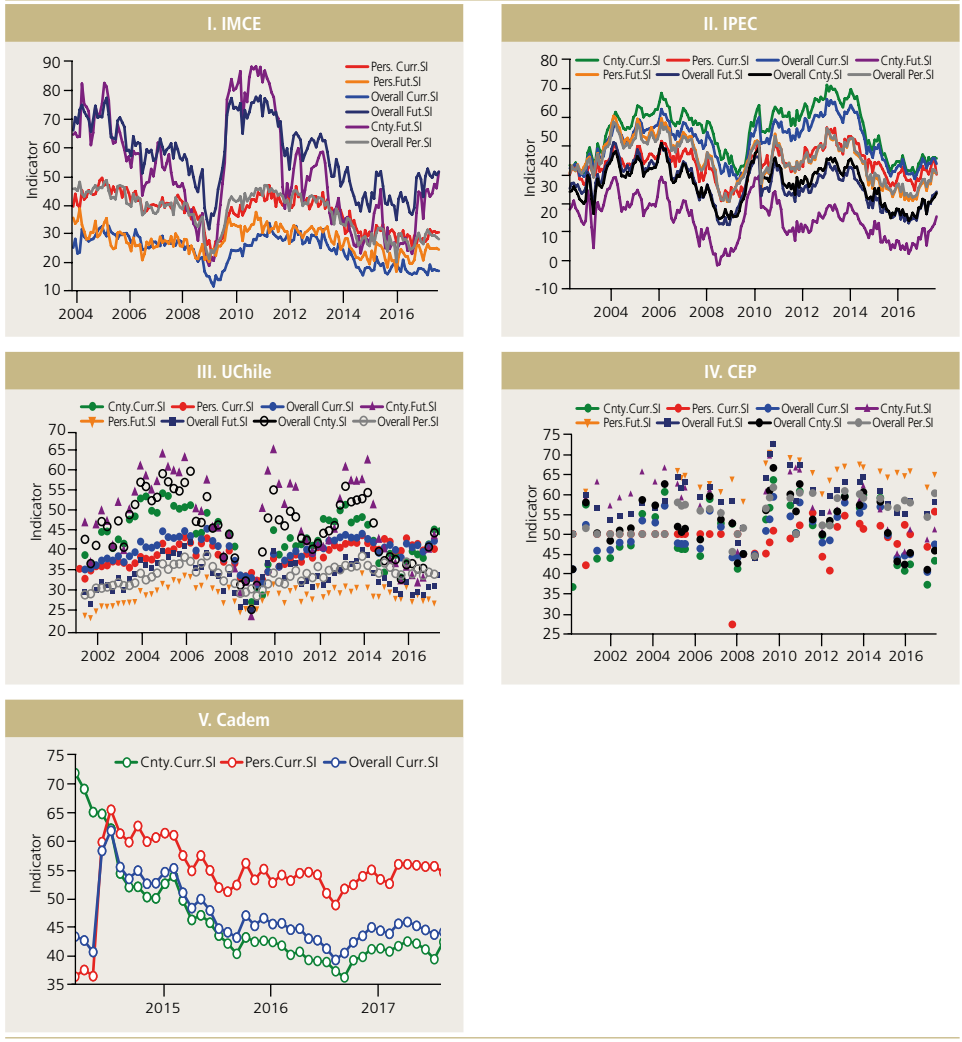
The construction of the alternative measures is detailed in appendix A; there are however a few things to note. First, the measures suggested here are simply a new way to average the balance statistics for each question and are not a new way to quantify qualitative data. Indeed, as detailed above, the balance statistic is a standard tool, and on a more practical level, the microdata of the different surveys were not available or exploitable when this paper was elaborated.

Second, the theoretical construction exposed above is limited by data availability. For instance, the IMCE survey does not ask backward-looking questions about the state of the country. As a result, three alternative measures cannot be constructed: the *Country Current Situation Indicator* (CCSI), the *Overall Current Sentiment Indicator* (OCSI) and the *Overall Country Indicator* (OCI). Similarly, the quality of an alternative measure can vary across surveys. Indeed, as the question's wording differs across surveys, the indicator might reflect very similar, but still different concepts (*e.g.* the question "How did the income of your household vary in the last 12 months?" is used as a proxy to form the *UChile_PCSI*). Similarly, an alternative measure can be constructed out of only one question or out of five, which has an influence on its variance (although the precise effect on the variance, even assuming positive covariance between two questions composing a same indicator, is ambiguous). As regards the CEP, the alternative measures are of lower quality because of the uneven gaps between two observations. Concerning the IMCE, weights for the whole sequence are

constructed using the 2015 GDP; that is, weights are not changed every year.

Figure 1

Alternative measures per survey, full (individual) sample



Source: Authors' calculations.

Finally, even if table 2 made it clear that expectation questions were aimed at different horizons, we compute expectation indicators using questions from the same survey. The rationale behind it is that qualitative questions are vague by nature; and so is the time horizon. It can reasonably be argued that, in answering the question "In one year, will the economic situation of your household be better, the same or worse than today?", economic agents have a rather vague notion of "one year", and if they expect their economic situation to improve in 9 or 15 months from now, they are very likely to answer the same way.

Alternative measures

We turn to the analysis of the newly constructed alternative measures. This is done in three different ways. First, we consider the new measures as a univariate time series and examine its properties. Second, we can compare the measures of the same survey, answering questions such as "Do expectation indicators lead or lag situation indicators?" Third, we compare the same alternative measures from different surveys, and examine whether they behave consistently across surveys. Throughout this section, we only compare measures between one another, and, by now, not with economic aggregates.

Table 7 reports the standard deviation and a unit root test for the new alternative measures of the five different surveys. The unit root test used is the Philips-Perron test, robust to unspecified autocorrelation or heteroscedasticity in the error term. Several regularities are worth noting. First, the personal current sentiment has a smaller variance than the overall current indicator (except for Cadem). The same holds for the personal future expectations, to a lesser extent. On the other hand, the country's current sentiment always exhibits a greater variance than the personal current sentiment, and, except for the IPEC, country future expectations exhibit similar properties relative to personal future expectations. This seems to indicate that individual respondents' answers vary less when answering personal questions than when answering country-wide questions. However, there is no clear ranking in terms of variability between current sentiment and future expectations indicators. For example, the personal current sentiment indicator has a greater variance than personal future expectation in IMCE and UChile, but the contrary is true for IPEC and CEP. Similar results hold for country current situation and country future expectation measures, as well as for overall current sentiment and overall future expectations.

Statistical testing cannot reject the hypothesis of a unit root for most alternative measures. Note, however, that it cannot be correct that the true process underlying these alternative measures is a unit root: by construction, it is bounded by 0 and 100. The test is conducted nonetheless to underline the variability of most alternative measures, particularly in their persistence level. This issue is particularly important to remark, as a persistent result implies that respondents do answer consecutively above (or below) a situation abstractedly built by themselves. In bounded series like these, this result implies that local trends exist.

Figure 1 illustrates the differences in the trajectory of different measures. In some cases, they differ at the high frequency level; in others in the magnitude of cycles, trends, or levels. This suggests that there must be distinct information contained in each measure.

Table 7

Standard deviation and unit-root test statistical inference*

Survey	Indicator	IMCE	IPEC	UChile	CEP	Cadem
Standard deviations	Current Indicator	7.58	7.19	10.27	4.72	-
	Country Current Sentiment	-	9.84	6.24	7.14	8.93
	Personal Current Sentiment	6.35	6.06	2.91	4.65	6.09
	Country Future Expectations	19.29	8.04	10.36	7.23	-
	Personal Future Expectations	4.43	8.68	2.50	7.63	-
	Overall Current Sentiment	-	8.37	3.26	5.02	5.22
	Overall Future Expectations	12.03	8.04	4.01	5.72	-
	Overall Country	-	7.71	7.77	6.66	-
	Overall Personal	7.25	7.92	2.55	4.58	-
Unit root test (Philips-Perron unit root test at 5% significance level)	Current Indicator	YES	YES	YES	Gaps in time series	-
	Country Current Sentiment	-	YES	YES	Gaps in time series	YES
	Personal Current Sentiment	NO	NO	YES	Gaps in time series	YES
	Country Future Expectations	YES	YES	YES	Gaps in time series	-
	Personal Future Expectations	NO	YES	NO	Gaps in time series	-
	Overall Current Sentiment	-	YES	YES	Gaps in time series	YES
	Overall Future Expectations	YES	NO	NO	Gaps in time series	-
	Overall Country	-	YES	YES	Gaps in time series	-
	Overall Personal	YES	YES	YES	Gaps in time series	-

Source: Authors' calculations.

* Upper panel: Dark beige cells = smaller than existing synthetic indicator. Light beige cells = standard deviation greater than 10.

Lower panel: Dark beige cells = no unit root found. Light beige cells = presence of unit root.

Same-survey analysis

The comparison of these newly constructed measures within surveys can answer several interesting questions. Do personal indicators (PCSI, PFEI, OPI) indicate the same matter as country-wide indicators (CCSI, CFEI, OCI)?, where "indicate" needs to be properly defined. If so, does it indicate the same thing within the same period, with a lead or with a lag? Similarly, how are current situation indicators (CCSI, PCSI, OCSI) related to expectation indicators (CFEI, PFEI, OFEI)? Are expectation indicators leading current indicators, or are they rather contemporaneously related? This would provide interesting hints as to how the economic agents form their expectations. A further interesting issue is the relation of these newly built alternative measures with the existing synthetic indicator: which of the new measures are the most similar? which one behaves differently?

Two different statistical tools are used in the comparison: the correlation coefficient and a bivariate Granger causality test. In what follows, when stated "indicator X Granger causes indicator Y", it is implied that the test result is significant at the 5% level. Such causality, in time, is defined in a statistical dimension, that is, the degree of independence in their distribution, rather than economic causality. So, when a variable A "causes" variable B, it means that

current values of *A* are statistically related with future values of *B*. Conversely, when a variable *A* does "not cause" variable *B*, it means that the distribution of the latter is not affected by the former, which could be interpreted as being generated by a different process.

As this sub-section is about within-survey comparison, the frequency used is the original frequency of the surveys: quarterly for UChile, monthly for IMCE and IPEC, monthly with gaps for CEP, and weekly for Cadem. Finally, it is worth noting that the levels of any two indicators cannot be compared, for two reasons. First, for some indicators (such as the *personal current sentiment index* in IMCE, see appendix A), some questions enter negatively, thereby changing the neutral value of the indicator. Second, and more importantly, the level of an indicator does not per se provide much information about what is indicating. For instance, an improvement in the business situation is not reflected by a merely "high" level, but a "higher-than-normal" level.

Table 8 presents the comparison between *personal* and *country-wide measures* within surveys. The first thing to do when analyzing the table is to recognize that, for each compared pair of measures, they have no questions in common, so, there is no embedded artificial correlation. Interestingly, the UChile and CEP surveys display very similar levels of correlation between any two compared indicators, while the IPEC correlation coefficients are always greater. A possible explanation could be that households surveyed by IPEC tend to respond similarly to all questions, but this is less the case for CEP and UChile surveys. In terms of Granger causality, there is no consistent link across surveys between personal and country measures: while *country sentiment* Granger causes *personal sentiment* in IPEC, the reverse is true in UChile, and the Granger causality test in Cadem reveals that neither causes the other. In addition, the most common result of Granger causality tests between a *personal* indicator and a *country-wide* indicator is that neither Granger causes the other. Intuitively, it means that past values of an indicator *X* cannot bring additional explanatory power to the current value of indicator *Y* when past values of indicator *Y* are already taken into account. Therefore, *personal* indicators (whether *current sentiment* or *future expectations*) do not tend to lead or lag *country-wide* indicators, while for all available surveys (that is, only IPEC and UChile), the former Granger causes the latter. This suggests that perceptions at the country-wide level tend to be formed independently of perceptions at the individual level.

Table 9 compares *current sentiment* indicators with *future expectation* indicators. As in table 8, any pair of compared alternative measures has no overlapping questions. Strikingly, there is a relatively stable relationship across surveys in the correlation coefficients between *personal current sentiment* and *personal future expectation*, and between *country current sentiment* and *country future expectation* (and, as a result, between *overall current sentiment* and *overall future expectations*). Indeed, the alternative measure most correlated with *personal current sentiment* is always *personal future expectations*, and not *country* or *overall future expectations*. For *country current sentiment*, the same is true (*country future expectation* is the most correlated alternative measure), with

the exception of IPEC, in which the most correlated alternative measure is the *personal future expectation*, in line with the result of the previous sub-section. This reinforces the notion that there is a little connection between personal and country-wide perceptions, possibly responding to different processes.

Table 8

Personal versus country-wide alternative measures: correlation and Granger causality

Survey		IMCE	IPEC	UChile	CEP	Cadem
Personal versus Country-wide indicators (Country Current Sentiment, Personal Current Sentiment, Country Future Expectations, Personal Future Expectations, Overall Country, Overall Personal)						
Personal current sentiment	Country Current Sentiment	-	Correlation: 0.862 Granger causality: Country Sentiment causes Personal Sentiment	Correlation: 0.498 Granger causality: Personal Sentiment causes Country Sentiment	Correlation: 0.012 Granger causality: Too many gaps in time series	Correlation: 0.863 Granger causality: Neither causes the other
	Country Future Expectation	Correlation: 0.714 Granger causality: Country Expectations causes Personal Sentiment	Correlation: 0.662 Granger causality: Country Expectation causes Personal Sentiment	Correlation: 0.278 Granger causality: Neither one causes the other	Correlation: 0.171 Granger causality: Too many gaps in time series	-
	Overall Country	-	Correlation: 0.854 Granger causality: Both cause each other	Correlation: 0.386 Granger causality: Personal Sentiment causes Overall Country	Correlation: 0.071 Granger causality: Too many gaps in time series	-
Personal future expectation	Country Current Sentiment	-	Correlation: 0.786 Granger causality: Personal Expectation causes Country sentiment	Correlation: 0.581 Granger causality: Personal Expectation causes Country Sentiment	Correlation: 0.397 Granger causality: Too many gaps in time series	-
	Country Future Expectation	Correlation: 0.808 Granger causality: Country Expectations causes Personal Expectations	Correlation: 0.826 Granger causality: Neither one causes the other	Correlation: 0.600 Granger causality: Neither one causes the other	Correlation: 0.184 Granger causality: Too many gaps in time series	-
	Overall Country	-	Correlation: 0.918 Granger causality: Neither one causes the other	Correlation: 0.633 Granger causality: Neither one causes the other	Correlation: 0.350 Granger causality: Too many gaps in time series	-
Overall personal	Country Current Sentiment	-	Correlation: 0.822 Granger causality: Neither one causes the other	Correlation: 0.547 Granger causality: Overall Personal causes Country Sentiment	Correlation: 0.338 Granger causality: Too many gaps in time series	-
	Country Future Expectation	Correlation: 0.827 Granger causality: Country Expectations causes Overall Personal	Correlation: 0.825 Granger causality: Neither one causes the other	Correlation: 0.419 Granger causality: Neither one causes the other	Correlation: 0.240 Granger causality: Too many gaps in time series	-
	Overall Country	-	Correlation: 0.935 Granger causality: Neither one causes the other	Correlation: 0.499 Granger causality: Overall Personal causes Overall Country	Correlation: 0.328 Granger causality: Too many gaps in time series	-

Source: Authors' calculations.

Table 9

Current situation versus future expectations alternative measures: correlation and Granger causality

Survey		IMCE	IPEC	UChile	CEP	Cadem
Current Situation versus Future Expectations indicators (Country Current Sentiment, Personal Current Sentiment, Country Future Expectations, Personal Future Expectations, Overall Current Sentiment, Overall Future Expectation)						
Personal current sentiment	Personal Future Expectation	Correlation: 0.663 Granger causality: Expectations causes the Current Situation	Correlation: 0.774 Granger causality: Expectation causes Current Sentiment	Correlation: 0.769 Granger causality: Neither causes the other	Correlation: 0.056 Granger causality: Too many gaps in time series	-
	Country Future Expectation	Correlation: 0.715 Granger causality: Expectations causes the Current Situation	Correlation: 0.663 Granger causality: Expectation causes Current Situation	Correlation: 0.279 Granger causality: Neither causes the other	Correlation: 0.172 Granger causality: Too many gaps in time series	-
	Overall Future Expectation	Correlation: 0.796 Granger causality: Expectations causes the Current Situation	Correlation: 0.761 Granger causality: Both cause each other	Correlation: 0.540 Granger causality: Neither causes the other	Correlation: 0.146 Granger causality: Too many gaps in time series	-
Country current sentiment	Personal Future Expectation	-	Correlation: 0.787 Granger causality: Expectation causes Current Situation	Correlation: 0.581 Granger causality: Personal Expectation causes Country Sentiment	Correlation: 0.398 Granger causality: Too many gaps in time series	-
	Country Future Expectation	-	Correlation: 0.546 Granger causality: Expectation causes Current Situation	Correlation: 0.734 Granger causality: Neither causes the other	Correlation: 0.695 Granger causality: Too many gaps in time series	-
	Overall Future Expectation	-	Correlation: 0.719 Granger causality: Expectation causes Current Situation	Correlation: 0.747 Granger causality: Overall Expectation causes Country Sentiment	Correlation: 0.704 Granger causality: Too many gaps in time series	-
Overall current sentiment	Personal Future Expectation	-	Correlation: 0.804 Granger causality: Expectation causes Current Situation	Correlation: 0.768 Granger causality: Neither causes the other	Correlation: 0.711 Granger causality: Too many gaps in time series	-
	Country Future Expectation	-	Correlation: 0.589 Granger causality: Expectation causes Current Situation	Correlation: 0.497 Granger causality: Neither causes the other	Correlation: 0.320 Granger causality: Too many gaps in time series	-
	Overall Future Expectation	-	Correlation: 0.748 Granger causality: Expectation causes Current Situation	Correlation: 0.681 Granger causality: Neither causes the other	Correlation: 0.712 Granger causality: Too many gaps in time series	-

Source: Authors' calculations.

The Granger causality tests provide another interesting insight: whenever an alternative measure Granger causes another, it is always the *expectation*

indicator causing the *current sentiment* alternative measure. This result is very strong for the IPEC and IMCE surveys: out of all possible comparisons, the *expectation indicator* Granger causes the *current sentiment indicator*, whereas the reverse does not hold. This regularity is less strong for the UChile indicator, in which out of nine possible pairs of indicators to be compared, the Granger causality test is inconclusive in seven cases (neither variable causes the other). However, in the cases it is conclusive (*personal future expectations*/*country current sentiment* and *country current sentiment*/*overall future expectations*), *expectations* Granger-cause the *current sentiment* indicator. This is a clear indication that *future expectations* do lead *current sentiment*. Assuming that current sentiment indicators do indeed reflect the current state of the economy, it implies that agents, when forming their expectations about the future, do not simply refer to their current situation (*i.e.* their expectations are not simply adaptive) but do engage in some forecasting process which, in turn, has some influence on their perceptions of the current situation. In other words, expectations about the future, which draw from external information, tend to influence the interpretation of the current situation.

Table 10 compares the newly built alternative measures and the currently used synthetic indicator. Unlike in table 8 or 9, some questions are often used to construct both alternative measures in a pair. Therefore, in these cases where the correlation is calculated with indicators sharing the same questions, their relationship is artificially strong. In order to take this into account and to better interpret the results, an indicator of common questions is constructed and shown in parentheses. In cases where this indicator is higher than 25% are highlighted. In calculating the percentage of common questions, we take into account the possibility that not all alternative measures are built with the same number of questions, and a probability-like formula is thus used.[8]

Bearing this limitation in mind, we can however underline an interesting fact in table 10. The relation between the existing synthetic indicator and personal or overall alternative measures is not very clear in terms of Granger causality. This is probably because the existing indicator aggregates all questions (in particular current sentiment and expectation questions) and thus each alternative measure partly influences and is influenced by the existing synthetic indicator. Indeed, there is a tendency for expectation indicators to Granger cause aggregate indicators (IMCE and IPEC), reflecting the fact that existing indicators incorporate current sentiment questions.

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8 The construction of the common questions index is as follows: Let X and Y be two different alternative measures, #X and #Y be the number of questions asked to build alternative measures X and Y, respectively, and #C be the number of common questions. The index I of common questions is constructed using the following formula: $I(X,Y) = \#C / (\#X + \#Y - \#C)$. As $\#C \leq min(\#X, \#Y)$, $I(X,Y)$ lies always between 0 and 1 when indicator X is made of a subset of questions asked to construct the alternative measure Y, then $= \#C = \#X$ and $I(X,Y) = \#X/\#Y$. The drawback of this indicator is that when $\#X = \#Y$ but $X \neq Y$, then $I(X, Y) < \#C/\#X$ and thus underestimates the percentage of common questions.

Table 10

Existing synthetic indicators and alternative measures: correlation and Granger causality*

Survey	IMCE	IPEC	UChile	CEP	Cadem
			Relation to current Indicator		
Country current sentiment	-	Correlation: 0.931 (17) Granger causality: Neither causes the other	Correlation: 0.857 (13) Granger causality: Indicator causes Country Sentiment	Correlation: 0.781 (50) Granger causality: Too many gaps in time series	-
Personal current sentiment	Correlation: 0.936 (50) Granger causality: Personal Sentiment causes Indicator	Correlation: 0.914 (20) Granger causality: Both cause the other	Correlation: 0.714 (38) Granger causality: Neither causes the other	Correlation: 0.404 (00) Granger causality: Too many gaps in time series	-
Country future expectations	Correlation: 0.772 (14) Granger causality: Country Expectations causes Indicator	Correlation: 0.752 (14) Granger causality: Country Expectations causes Indicator	Correlation: 0.850 (13) Granger causality: Neither causes the other	Correlation: 0.698 (00) Granger causality: Too many gaps in time series	-
Personal future expectations	Correlation: 0.793 (18) Granger causality: Neither causes the other	Correlation: 0.866 (13) Granger causality: Personal Future Expectations causes Indicator	Correlation: 0.861 (38) Granger causality: Neither causes the other	Correlation: 0.718 (00) Granger causality: Too many gaps in time series	-
Overall current sentiment	-	Correlation: 0.951 (33) Granger causality: Neither causes the other	Correlation: 0.865 (50) Granger causality: Neither causes the other	Correlation: 0.805 (33) Granger causality: Too many gaps in time series	-
Overall future expectations	Correlation: 0.878 (30) Granger causality: Overall Expectation causes Indicator	Correlation: 0.856 (20) Granger causality: Overall Expectations causes Indicator	Correlation: 0.953 (50) Granger causality: Neither causes the other	Correlation: 0.920 (00) Granger causality: Too many gaps in time series	-
Overall country	-	Correlation: 0.946 (25) Granger causality: Overall Country causes Indicator	Correlation: 0.911 (25) Granger causality: Overall Country causes Indicator	Correlation: 0.765 (50) Granger causality: Too many gaps in time series	-
Overall personal	Correlation: 0.979 (80) Granger causality: Both cause the other	Correlation: 0.899 (25) Granger causality: Neither causes the other	Correlation: 0.811 (75) Granger causality: Neither causes the other	Correlation: 0.804 (00) Granger causality: Too many gaps in time series	-
Inflation expectations	Correlation: 0.649 (00) Granger causality: Both cause the other	Correlation: -0.286 (00) Granger causality: Neither causes the other	-	-	-
Investment expectations	Correlation: 0.575 (33) Granger causality: Index causes Investment Expectations	Correlation: 0.872 (00) Granger causality: Neither causes the other	-	-	-
Consumption expectations	Correlation: 0.926 (20) Granger causality: Both cause the other	Correlation: 0.850 (14) Granger causality: Neither causes the other	Correlation: 0.853 (63) Granger causality: Neither causes the other	-	-
Employment expectations	Correlation: 0.661 (14) Granger causality: Index causes Employment Expectation	Correlation: 0.798 (00) Granger causality: Neither causes the other		-	-

Source: Authors' calculations.

* In parentheses the percentage of common questions asked to form any two alternative measures. Brown-shaded cells=variables having more than 25% of questions in common.

Cross-survey analysis

We turn to the analysis of each alternative measure across different surveys. Unlike with the previous analysis, we are now interested in finding out whether alternative measures behave in the same way across surveys. One additional issue when comparing alternative measures across surveys is the time frequency of these surveys. As shown in table 11, we choose to compare surveys at the lowest frequency because of an aggregation issue. It is indeed easier to go from monthly to quarterly data using the quarterly average rather than the other way around. Therefore, comparisons with UChile are made on a quarterly basis, whereas the other comparisons are made on a monthly basis. It is also important to note that for some comparisons (such as between Cadem and UChile, or Cadem and CEP), very few common periods are available, leading to small-sample bias.

In this analysis, we cannot use the same statistical tools as in previous sections. The Granger causality analysis is hindered by the few possible comparisons, either because there is no indicator available, or because of the gaps or low number of common observations. However, a graphical comparison such as that of figure 2 plus the correlation analysis of table 12 reveal some stylized facts. First, the existing synthetic IPEC, CEP, and UChile indicators, which focus on households, do co-move greatly together. This is naturally less the case for the IMCE current indicator, as it focuses on businesses.

Table 11

Frequency and time range of comparison across surveys

	IMCE	IPEC	UChile	CEP
IPEC	monthly 06/2004 - 07/2017 (165 periods)	-	-	-
UChile	quarterly 2004q3 - 2017q2 (55 periods)	quarterly 2002q1 - 2017q2 (62 periods)	-	-
CEP	monthly 12/2003 - 05/2017 (34 periods)	monthly 07/2002 - 05/2017 (37 periods)	quarterly 03/2014 - 05/2017 (19 periods)	-
Cadem	monthly 03/2014 - 08/2017 (41 periods)	monthly 03/2014 - 08/2017 (41 periods)	quarterly 03/2014 - 08/2017 (14 periods)	monthly 07/2014 - 08/2017 (8 periods)

Source: Authors' calculations.

Figure 2

Time series of the new alternative measures across surveys

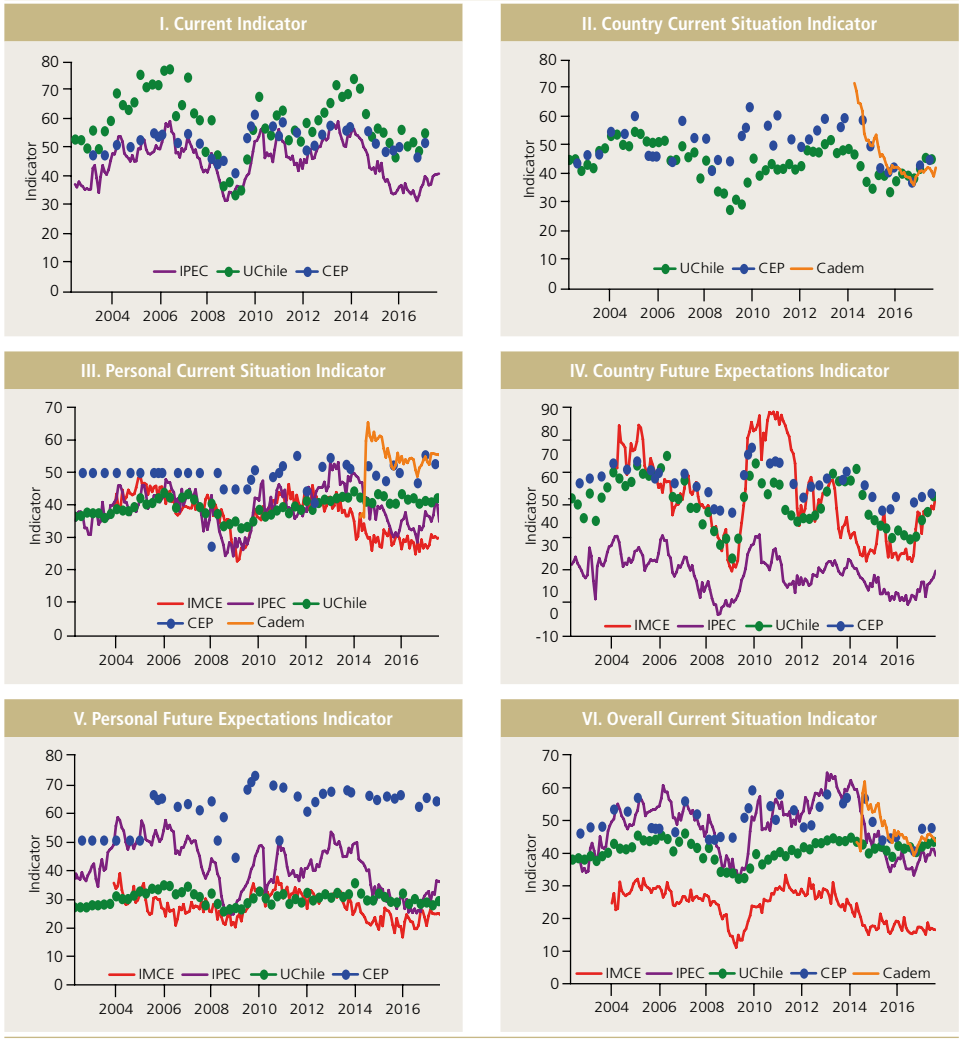
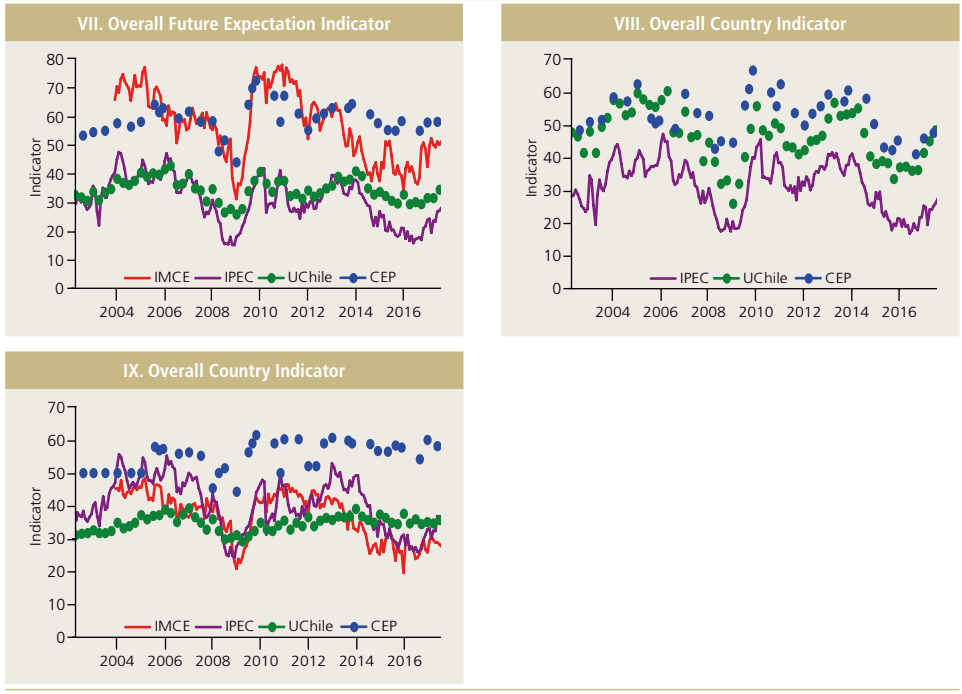


Figure 2 (continued)

Time series of the new alternative measures across surveys



Source: Authors' calculations.

If we focus on the correlation of the household surveys' alternative measures, the correlation is higher for *country-wide* rather than for *personal* indicators. Compare, for instance, the correlation from *personal future expectation*, *overall personal indicator* with their *country-wide* counterpart. Interestingly, the *country current situation indicator* is relatively poorly correlated across surveys, with the exception of the Cadem survey. This lower correlation, however, does not necessarily contradict the claim that country-wide questions are measuring the same concept across surveys, being the different surveyed sample the most plausible explanation for these lower correlations. Nevertheless, this casts doubts on the capacity of the personal indicators to be representative: ideally, all indicators should be the same across surveys. There is however no similar relationship between *current situation* and *expectation* indicators, even if the indicator with the highest correlation across all surveys is the *country future expectation* indicator.

Finally, it is important to note that these relationships are not transitive at all. For instance, even if the existing *country current situation* indicator is highly correlated between Cadem and IPEC (0.932) and IPEC and UChile (0.649), the correlation coefficient between Cadem and UChile is 0.366. We can find a similar non-transitive relationship with the *overall personal* indicator between IPEC and IMCE (0.852), UChile and IPEC (0.790), and CEP and IMCE (0.182).

Table 12

Comparison of alternative measures across surveys: correlation coefficient*

	Correlation											
	IMCE	IPEC	UChile	CEP	IMCE	IPEC	UChile	CEP	IMCE	IPEC	UChile	CEP
	Current Indicator				Country Future Expectation Index				Overall Future Expectation Index			
IMCE	1	-	-	-	1	-	-	-	1	-	-	-
IPEC	0.733†	1	-	-	0.834†	1	-	-	0.874†	1	-	-
UChile	0.789†	0.879†	1	-	0.894†	0.942†	1	-	0.865†	0.947†	1	-
CEP	0.492†	0.758†	0.696†	1	0.915†	0.945†	0.953†	1	0.687†	0.676†	0.752†	1
Cadem	-	-	-	-	-	-	-	-	-	-	-	-
	Country Current Situation Index				Personal Future Expectation Index				Overall Country Index			
IMCE	-	-	-	-	1	-	-	-	1	-	-	-
IPEC	-	1	-	-	0.873†	1	-	-	-	1	-	-
UChile	-	0.649†	1	-	0.641	0.828†	1	-	-	0.921†	1	-
CEP	-	0.626†	0.427†	1	0.147	0,182	0.294†	1	-	0.828†	0.754†	1
Cadem	-	0.932†	0.366†	0.955†	-	-	-	-	-	-	-	-
	Personal Current Situation Index				Overall Current Situation Index				Overall Personal Index			
IMCE	1	-	-	-	1	-	-	-	1	-	-	-
IPEC	0.536†	1	-	-	0.759†	1	-	-	0.852†	1	-	-
UChile	0.077	0.620†	1	-	0.448†	0.648†	1	-	0.596	0.790†	1	-
CEP	-0.015	0.180†	0.226	1	0.421†	0.608†	0.493	1	0.182	0.292	0.295	1
Cadem	0.396	-0.141	-0.013	0.267	0.011	0.405†	0.047	0.927†	-	-	-	-

Source: Authors' calculations.

* †=statistically significant at 5%.

IV. ASSESSING FORECASTING CAPACITY

1. Perceptions and anticipated behavior

The main purpose of this paper is to assess how much economic perceptions surveys can contribute to macroforecasting. In this section, we focus on this ability to forecast key macro aggregates. First, we examine whether IMCE-based alternative indicators provide a significant advantage in forecasting investment, within a traditional statistical forecasting model. Second, we perform the same exercise replacing investment by total employment. Finally, we turn to IPEC alternative measures for private consumption multi-horizon forecasting. In all cases, we take an agnostic point of view regarding the alternative measures usage, in the sense that we have no any *a priori* bias towards a certain alternative measure. Instead, we are interested in unravelling the predictive ability of IMCE and IPEC.

More precisely, we compare whether using alternative measures provides forecasting gains compared to the existing synthetic indicators, and when using no indicator of any type at all. By doing so, we analyze the merits of using alternative measures, closely following the methodology of Medel et al. (2016) for the case of domestic inflation predicted with versus without global factors.

Table 13

Relative root mean squared error comparison: consumption, employment, and investment *

Private consumption: Total										
IPEC	CCSI	PCSI	CFEI	PFEI	OCSI	OFEI	OCI	OPI	Aggregate (†)	No factor (††)
$h = 1$	1.009	1.058	0.856	1.021	1.017	1.011	1.027	1.076	0.889	1.271
$h = 2$	0.672	1.012	0.959	0.734	0.791	1.321*	0.739*	0.764	1.362*	0.792
$h = 3$	0.741	0.930	0.879	0.772	0.803	0.941	0.811	0.819	1.096*	1.579
$h = 4$	0.499*	0.920	1.203	0.805	0.656	1.186	0.608	0.806	1.013*	1.297
Adjusted R^2	0.982	0.987	1.009	0.979	0.985	0.995	0.994	0.975	1.042	0.832
Private consumption: Non-durable										
IPEC	CCSI	PCSI	CFEI	PFEI	OCSI	OFEI	OCI	OPI	Aggregate (†)	No factor (††)
$h = 1$	1.083	1.238**	0.885	1.238**	1.109**	1.075	1.004	1.262**	0.716	1.785
$h = 2$	0.832**	1.152*	0.979	1.026	0.916	0.973	0.907	1.043	0.681	2.249
$h = 3$	0.903	1.188	0.965	1.027	0.956	0.936	0.957	1.071	0.551	2.846
$h = 4$	1.080	1.272	1.653*	1.278	1.077	1.237	1.171	1.441**	0.308	3.347
Adjusted R^2	0.973	0.970	1.024	0.948	0.974	0.982	1.003	0.949	1.137	0.707
Private consumption: Durable										
IPEC	CCSI	PCSI	CFEI	PFEI	OCSI	OFEI	OCI	OPI	Aggregate (†)	No factor (††)
$h = 1$	1.092	0.952	0.986	0.878	1.003	0.913	1.186	1.023	0.751	4.677
$h = 2$	0.906	0.866	1.014	0.813*	0.851*	0.911	1.062	0.823*	1.144***	4.869
$h = 3$	0.763*	0.917	0.870	0.744**	0.766**	0.809*	0.977	0.756*	1.225***	6.304
$h = 4$	0.699	0.978	0.818**	0.654*	0.723**	0.736	0.892	0.639*	1.755***	5.060
Adjusted R^2	0.987	0.990	1.011	0.997	0.989	1.004	0.998	0.991	1.041	0.861
Employment										
IMCE	CCSI	PCSI	CFEI	PFEI	OCSI	OFEI	OCI	OPI	Aggregate (†)	No factor (††)
$h = 1$	-	0.902	0.994	1.214	1.000	1.255	-	1.177	0.916*	0.638
$h = 2$	-	0.967	1.398*	1.297	0.781	1.734**	-	1.593**	0.686**	1.030
$h = 3$	-	1.144	1.786**	1.390	0.774	2.229**	-	2.038*	0.494**	1.301
$h = 4$	-	1.077	1.587*	1.035	0.741	2.014**	-	1.964*	0.414**	1.620
Adjusted R^2	-	0.992	1.059	1.017	0.982	1.046	-	1.012	1.033	0.759
Gross Fixed Capital Formation: Total										
IMCE	CCSI	PCSI	CFEI	PFEI	OCSI	OFEI	OCI	OPI	Aggregate (†)	No factor (††)
$h = 1$	-	1.181	1.095	1.234	1.008	1.168	-	1.136	0.734	5.972
$h = 2$	-	1.623**	0.979	1.423	1.182	1.173	-	1.379*	0.495*	8.280
$h = 3$	-	1.059	0.782	1.118	0.477***	0.954	-	1.202	0.518***	8.854
$h = 4$	-	1.367	0.792	1.632*	0.824	0.631***	-	1.232	0.319***	9.853
Adjusted R^2	-	0.993	0.980	0.959	0.994	0.977	-	0.992	1.069	0.843
Gross fixed capital formation: Machinery and equipment										
IMCE	CCSI	PCSI	CFEI	PFEI	OCSI	OFEI	OCI	OPI	Aggregate (†)	No factor (††)
$h = 1$	-	1.281**	0.905	1.350	1.136	1.120	-	0.963	0.816	12.518
$h = 2$	-	1.539***	0.806	1.479	1.244	1.122	-	1.157	0.536	19.553
$h = 3$	-	1.239	0.937	0.952	0.851	1.330	-	1.364	0.370	21.215
$h = 4$	-	1.462**	1.156	1.947	1.321	1.400**	-	1.373	0.243	26.831
Adjusted R^2	-	0.968	0.998	0.945	0.987	0.988	-	1.000	1.088	0.768
Gross fixed capital formation: Construction and works										
IMCE	CCSI	PCSI	CFEI	PFEI	OCSI	OFEI	OCI	OPI	Aggregate (†)	No factor (††)
$h = 1$	-	1.239	1.128	1.050	1.078	1.065	-	1.106**	0.750	2.870
$h = 2$	-	1.340	1.262	1.187	1.166	1.152	-	1.130	0.615	5.276
$h = 3$	-	1.165	1.156	1.167	0.979	1.086	-	1.067**	0.617	7.085
$h = 4$	-	1.015	1.159	1.220	0.879	1.015	-	0.888	0.571	7.831
Adjusted R^2	-	0.996	0.954	0.961	1.004	0.964	-	0.985	1.058	0.855

Source: Authors' calculations.

* For models augmented with CCSI, PCSI, CFEI, PFEI, OCSI, OFEI, OCI, and OPI: Relative RMSFE between alternative measure-augmented model and model augmented with existing synthetic indicator (Harvey-Leybourne-Newbold test: ***: p<1%, **: p<5%, *: p<10%). (†) For "Existing" model: Relative RMSFE between existing synthetic indicator-augmented model and no-augmentation model (Clark-West test: ***: p<1%, **: p<5%, *: p<10%). (††) Root mean squared forecast error.

Besides private consumption and investment aggregates, we also distinguish between the components of both series. For consumption, we perform the same exercise for *non-durable* and *durable* goods. For investment, we distinguish between *machinery and equipment* and *construction and works*.

The whole forecasting exercise is detailed in appendix B. Due to the small-sample bias, the statistical inference is based on Harvey et al. (1997)'s test of forecast accuracy. It is also complemented with Clark and McCracken's (2007) test of model adequacy. These both tests are described in appendix C. Notice that forecast accuracy is assessed in relative terms to ease a comparison across the different alternative measures, the existing synthetic indicator, and the forecast made without the information of any factor.

The measure used to compare is the traditional root mean squared forecast error (RMSFE) statistic. When comparing the influence of any alternative measure with respect to the existing synthetic indicator on forecast accuracy, the RMSFE ratio of the former upon the latter is used. Similarly, the influence of the existing synthetic indicator is compared upon the RMSFE of the forecast without any survey—*i.e.* that based on the information exclusively contained in the series. Forecast horizons are h =1, 2, 3, and 4-quarters-ahead, where h=1 corresponds to the case of nowcasting given the early availability of the survey prior to the macroaggregates.

In terms of the econometric model of private consumption and its relationship with IPEC, both in-sample adjustment and predictive results are presented in the upper three panels of table 13 (total private consumption, non-durable, and durable). In-sample results are referred to the *Adjusted* R^2 goodness-of-fit coefficient, which is also presented in relative terms (alternative measure versus existing synthetic indicator, and existing synthetic indicator versus no-survey-augmentation case). More in-sample diagnostics are presented in appendix B. The last column of table 13 ("*No factor*") shows the RMSFE by itself and the *Adjusted* R^2 row not in relative terms but in their original measuring units.

Regarding total private consumption, the goodness-of-fit coefficient plus the relative RMSFE of the existing synthetic indicator compared to the no-factor case, reveal the usefulness of re-defining the indicators contained in the IPEC survey. While the in-sample adjustment does improve when more information is included in the model, the predictive performance is spoiled out when the existing synthetic indicator is used, being statistically outperformed by the no-factor case at h>1. At h=1, all alternative measures are outperformed by the no-factor case, except for the *country future sentiment* indicator (CFEI)—but not in a statistically significant manner. However, at h>1, the results are reverted and almost all alternative measures display predictive gains of a non-negligible size. Particularly interesting is the case of the *current country* indicator (CCSI) displaying predictive gains (=1 – *Relative RMSFE*%) of 33%,

26%, and 50% across the horizon.[9] Despite some other remarkable predictive gains, such as 27% at h=2 with PFEI and 39% at h=4 with OCI, no case is statistically superior. Importantly, despite the different sample span used for the estimation, both the goodness-of-fit coefficient and the RMSFE improve with respect to the estimates shown in Cobb et al. (2011) for this aggregate.

Regarding non-durable consumption, the results are less promising compared to the previous case. In other words, due to the smoothness of this series, it is easier to capture their dynamic with past information estimating fewer regressors. Hence, the space available for exogenous information to explain the remaining dynamic is thus reduced. The goodness-of-fit coefficient reveals no particularly bigger explanatory power gains when using the alternative measures. These (relative) coefficients fluctuate between 0.948 and 1.024. Remarkably, the first, and the most important, difference with respect to the previous case is that the existing synthetic indicator provides the biggest predictive gains for each horizon. These are increased as the horizon lengthens, achieving 28.4%, 31.9%, 44.9%, and 69.2%, respectively. Note, however, that none of these predictive gains is statistically significant.

A more positive prospect for alternative measures is observed with durable consumption. In opposition to the non-durable component, there is enough space for the influence of external variables, noting a standard deviation five times greater (16.13 versus 3.14). Despite some minor explanatory gains accounted for by the goodness-of-fit coefficient, there are only 6 out of 32 cases in which the alternative measures do not outperform the existing synthetic indicator out-of-sample; these six cases, however, are not statistically significant.[10] Notice that, same with the aggregate consumption, *current indicator* performs poorly both in- and out-of-sample. The best forecasting results are obtained with the *personal future* (PFEI) and *personal overall* (OPI) alternative measures, which make sense in the context that durable consumption reflects personal level forward-looking spending.

In sum, the usefulness of building and using IPEC alternative measures in a "hard" manner for forecasting purposes is shown particularly in the case of aggregate and non-durable consumption, especially at longer horizons with the *country-wide current* and the *personal future* alternative measures.

The results for *total employment* are depicted in the middle panel of table 13. The results across the considered horizons are always favorable when using the existing synthetic indicator, exhibiting substantial predictive gains which

9 However, no case is statistically significant according to the Harvey et al. (1997) test. Instead, when using the original Diebold and Mariano (1995) test—without any correction—the candidate forecast is statistically significant at h=4.

10 Notice that when using the Diebold and Mariano (1995) test, nine cases become statistically significant. By horizons, these are: h=2: [OCSI,OPI], h=3: [PFEI,OFEI,OPI], and h=4: [CFEI,PFEI,OCSI,OPI].

are statistically significant. Yet, two alternative measures turn out to be even better than the synthetic: PCSI at h={1,6} and OCSI for all horizons (considering h=1 as a tie). Notice that both personal (PCSI) and overall (OCSI) indicators are referring to the current situation, which may be interpreted as that hiring decisions are based exclusively on what is currently happening instead of being a more forward-looking decision. This is consistent with research showing a high prevalence of short-term contracts and high turnover in the Chilean labor market (see Marcel and Naudon, 2016).

Regarding gross fixed capital formation, the results favor the use of the existing synthetic indicator over the no-augmentation case for forecasting purposes, as the predictive gains are considerable: from 26.6% to 68.1%, at h=1 and 4; the latter becoming the biggest of the whole exercise. In just one case (h=1), these gains are not statistically significant. Notice that these predictive gains are obtained in a context where only the existing indicator helps to explain in-sample investment dynamics, as the goodness-of-fit coefficient increases 7% whereas it is reduced with the alternative measures. The only cases where alternative measures improve over the existing indicator are: the *overall current sentiment* indicator (OCSI) at h=3 and *overall future* indicator (OFEI) at h=4. These cases exhibit gains of 52.3% and 36.9%, being the former statistically superior to the existing indicator at the 5% confidence level.

At first sight, the results for *machinery and equipment* look similar to the previous case, but with important differences in the use of the existing synthetic and alternative measures. First, despite the notorious predictive gains of the existing indicator—achieving a high 75.7% at h=4—none of them is statistically significant. Second, none of the six (out of 24) cases which actually display predictive gains is statistically significant. Finally, in three cases the alternative measure is statistically *inferior* to the existing synthetic indicator forecast. Overall, the evidence for IMCE as a predictor of *machinery and equipment* is pretty weak; complemented also with lower goodness-of-fit enhancements.

Finally, the case of *construction and works* is presented in the lower panel of table 13. This case is even more dramatic than *machinery and equipment* because existing synthetic indicator gains are lower than in the two previous cases, and there are virtually no obvious gains when using alternative measures. Note that small predictive gains are obtained with the same alternative measure that delivers positive results in the aggregate case, *i.e. overall current sentiment* indicator (OCSI). The goodness-of-fit coefficient is also weak to support the influence of alternative measures as a driver of *construction and works* fluctuations.

Overall, major—while non-significant—predictive gains are found with the existing indicator for the three variables, a secondary role is found for the OCSI alternative measure when forecasting total investment and *construction and works* at h=3 and 4. Hence, IMCE surveys do not necessarily describe the investment dynamics according to this analysis.

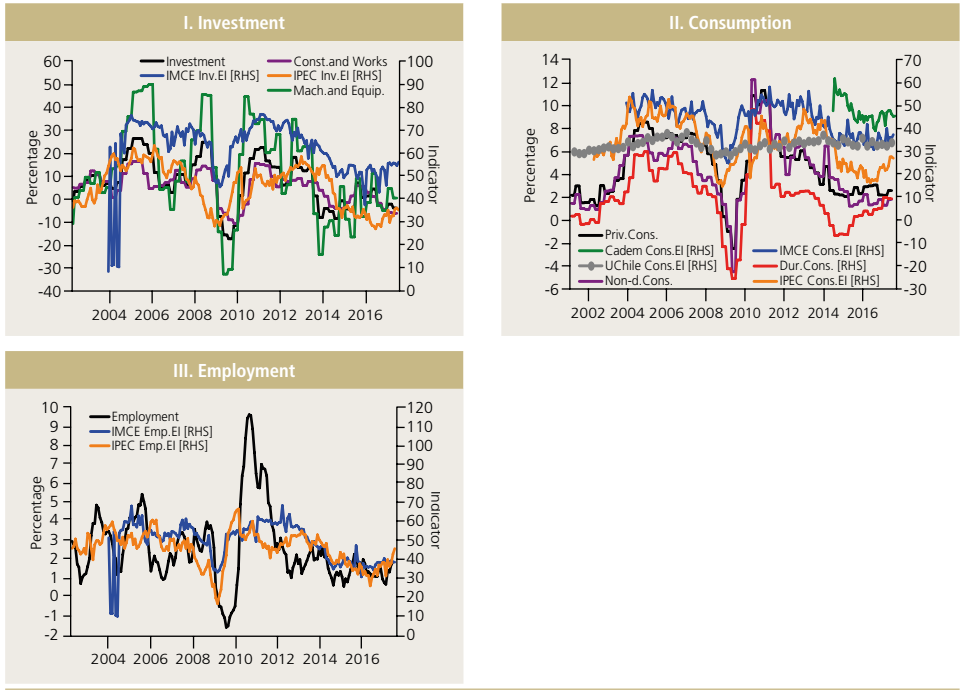
2. Macro aggregate action indicators

In this sub-section, we examine *macro aggregate action* indicators and their relationship with the proposed alternative measures and actual macro aggregates. The *macroaggregate action* indicators simply consist in group-specific questions aiming to target a macroeconomic aggregate. We refer to them as action indicators on two grounds. First, because they rely on some questions that refer directly to ongoing or planned actions (*e.g.* "How will your production evolve in the next three months?") Second, because other questions refer to perceptions on what others may be doing or opportunities to act, which, on the basis of behavioral economics, have proven very likely to prompt own actions. This could be understood as a *herding behavior* by survey respondents. Banerjee (1992) suggests that herding occurs when individuals do what everyone else does, even when their private information suggests they should take a different path.

This is an exclusively within-survey analysis, making use of the indicators of each survey constructed as shown in appendix D. Figure 3 depicts macro aggregate action time series as well as the growth rate of the macro aggregates they target.

Figure 3

Macroaggregate action indicators per macroeconomic aggregate, full (individual) available sample



Source: Authors' calculations.

We also integrate *economic action* indicators. By this, we mean potential decisions and/or actions by economic agents as measured by responses to questions related to plans, attitudes, or timing to make economic decisions, like consumption, employment, and investment. To undertake this task, we make use of the "individual questions requiring action" of table 4, becoming an exclusively within-survey analysis. Notice that, according to table 4, the analysis is possible to perform only for IMCE. Moreover, we concentrate on question 14: "How will the employment of your company evolve in the next three months?" and question 15: "How will the investments of your company evolve in the next six months?" (for commerce and manufacturing) aiming to explore if these answers are preceded by prospective personal/country alternative measures or vice versa. For this analysis, we exclude the mining sector because of the small number of surveyed individuals.

Tables 14-16 compare each macroaggregate action indicator with the previously analyzed alternative measures and the remaining macro aggregate action indicators in terms of correlation and Granger causality. Notice that the investment action indicator (table 14) is highly correlated with the employment indicator in IMCE. This is also true for IPEC although it is even more correlated with the consumption action indicator due to the "time to buy" questions (table 4). This result is also in line with the finding of Ceballos and González (2012), that the IPEC question on "time to buy" is significant among a group of high-frequency variables to build an economic conditions indicator for the Chilean economy. Interestingly, *personal expectation* alternative measures seem to lead and Granger cause investment actions more than do *country-wide* indicators (although there is not enough data in IMCE to strongly support the claim).

Further, overall expectations alternative measures Granger cause and lead investment action indicators both in IMCE and IPEC surveys, whereas investment actions Granger cause the alternative measures. This would indicate that both companies and households become prepared to invest only when they have been expecting economic improvement for at least one period. This is further supported by the fact that the investment question in IMCE has the same time horizon as business expectation questions (six months).

Consumption action indicators (table 15) are trickier to interpret due to the way they are constructed. For IMCE, this is essentially a demand/sales measure. The Granger causality test results are never constant across the surveys, even if the results are relatively similar for IPEC and UChile. This action indicator is indeed highly correlated with other indicators in the cases of IPEC and Cadem, but less in the case of IMCE. Moreover, there is no particular difference in the relationship between personal or general indicators and employment action.

Table 14

Investment action indicator and alternative measures: correlation and Granger causality*

Survey		IMCE	IPEC	UChile	CEP	Cadem
Macroaggregate action indicator: Investment						
Investment action	Country current sentiment	-	Correlation: 0.885 Granger Causality: Neither causes the other	-	-	-
	Personal current sentiment	Correlation: 0.607 Granger Causality: Business Sentiment causes Investment Action	Correlation: 0.790 Granger Causality: Investment Action causes Personal Situation	-	-	-
	Country future expectations	Correlation: 0.440 Granger Causality: Country Expectations causes Investment Action	Correlation: 0.719 Granger Causality: Country Expectations causes Investment Action	-	-	-
	Personal future expectations	Correlation: 0.385 Granger Causality: Personal Expectations causes Invesment Expectations	Correlation: 0.957 Granger Causality: Personal Expectations causes Investment Action	-	-	-
	Overall current sentiment	-	Correlation: 0.885 Granger Causality: Investment Action causes Overall Sentiment	-	-	-
	Overall future expectations	Correlation: 0.479 Granger Causality: Overall Expectations causes Investment Action	Correlation: 0.898 Granger Causality: Overall Expectations causes Investment Action	-	-	-
	Overall country	-	Correlation: 0.901 Granger Causality: Overall Country causes Investment Action	-	-	-
	Overall personal	Correlation: 0.563 Granger Causality: Overall Personal causes Investment Action	Correlation: 0.960 Granger Causality: Neither causes the other	-	-	-
	Consumption action	Correlation: 0.582 Granger Causality: Consumption Expectations causes Investment Action	Correlation: 0.965 Granger Causality: Neither causes the other	-	-	-
	Employment action	Correlation: 0.926 Granger Causality: Employment Action causes Investment Action	Correlation: 0.787 Granger Causality: Neither causes the other	-	-	-

Source: Authors' calculations.

* Brown-shaded cells=variables having more than 25% of questions in common.

Table 15

Consumption action indicator and alternative measures: correlation and Granger causality*

Survey		IMCE	IPEC	UChile	CEP	Cadem
Macroaggregate action indicator: Consumption						
Consumption action	Country current sentiment	-	Correlation: 0.794 Granger Causality: Consumption Action causes Country Sentiment	Correlation: 0.606 Granger Causality: Consumption Action causes Country Sentiment	-	Correlation: 0.807 Granger Causality: Neither causes the other
	Personal current sentiment	Correlation: 0.928 Granger Causality: Both cause the other	Correlation: 0.765 Grnger Causality: Consumption Action causes Personal Sentiment	Correlation: 0.905 Granger Causality: Neither causes the other	-	Correlation: 0.962 Granger Causality: Neither causes the other
	Country future expectations	Correlation: 0.767 Granger Causality: Country Expectations causes Consumption Action	Correlation: 0.776 Granger Causality: Neither causes the other	Correlation: 0.500 Granger Causality: Neither causes the other	-	-
	Personal future expectations	Correlation: 0.758 Granger Causality: Personal Expectations causes Consumption Action	Correlation: 0.994 Granger Causality: Neither causes the other	Correlation: 0.927 Granger Causality: Neither causes the other	-	-
	Overall current sentiment	-	Correlation: 0.808 Granger Causality: Consumption Action causes Overall Sentiment	Correlation: 0.898 Granger Causality: Neither causes the other	-	Correlation: 0.899 Granger Causality: Neither causes the other
	Overall future expectations	Correlation: 0.850 Granger Causality: Overall Expectations causes Consumption Action	Correlation: 0.945 Granger Causality: Neither causes the other	Correlation: 0.757 Granger Causality: Neither causes the other	-	-
	Overall country	-	Correlation: 0.890 Granger Causality: Neither causes the other	Correlation: 0.577 Granger Causality: Neither causes the other	-	-
	Overall personal	Correlation: 0.916 Granger Causality: Overall Personal causes Consumption Action	Correlation: 0.989 Granger Causality: Neither causes the other	Correlation: 0.974 Granger Causality: Neither causes the other	-	-
	Investment action	Correlation: 0.582 Granger Causality: Consumption Action causes Investment Action	Correlation: 0.965 Granger Causality: Neither causes the other	-	-	-
	Employment action	Correlation: 0.663 Granger Causality: Consumption Action causes Employment Action	Correlation: 0.761 Granger Causality: Neither causes the other	-	-	Correlation: 0.880 Granger Causality: Neither causes the other

Source: Authors' calculations.

* Brown-shaded cells=variables having more than 25% of questions in common.

The case of UChile survey depicts two remarkable facts. First, the consumption action indicator is highly correlated with personal alternative measures both current and expected, and consequently with the overall personal indicator. Second, a high correlation with the overall current alternative measure but below that excluding the country dimension (*i.e.* overall personal current indicator) reveals that UChile respondents strongly associate their personal situation with their own consumption rather than with the general country situation; a fact reinforced by the relatively low correlation with the country current and future measures.

Finally, table 16 shows the results for the employment indicator, which is available for IMCE, IPEC, and Cadem only. As mentioned above, the IMCE employment action indicator is highly correlated and Granger causes the investment action indicator. This is not the case with the remaining IMCE indicators. When analyzing IPEC, it is more common to find a high correlation coefficient with the overall and the prospective (country-wide and personal) indicators than with the current ones. The results for Cadem are more difficult to read since the four computable correlations are high (possibly due to small-sample bias), and neither indicator Granger causes the other.

In sum, both employment and investment action indicators are mostly correlated between them within the entrepreneurs IMCE survey, and with country-based alternative measures both current and expected. From the consumer's point of view, IPEC's investment actions are highly correlated with consumption actions because of "time to buy" questions. At the same time, UChile-based consumption actions reflect well the personal rather than country situation, which is reverted in the analysis of employment actions.

We now turn to analyze the single-question-based economic action indicators. In particular, we proceed with the Granger causality tool to estimate if *country-future* and *personal-current, personal-expected* and *personal-overall* indicators Granger cause actions regarding investment and employment. As Granger causality could be considered a generalist model-free view on the effect of one variable on another, we are not investigating how many months the respondent takes to make a decision of some magnitude of influence. Instead, we are investigating if there is systematic evidence that indicators anticipate actions (or the other way around). This is possible to make as variables have a memory, and not all lags must be necessarily included in the Granger causality regression. Hence, Granger causality emerges as a valid tool for our purposes.

The results for employment actions are presented in table 17. For the commerce sector, two feedback results are obtained: those of PFEI and OPI interacting with hiring plans at a 3-month horizon. Thus, country future sentiment Granger causes hiring plans, which in turn cause personal current sentiment. Similar building blocks are obtained in the manufacturing sector. The only difference is that 3-month hiring plans cause not only current but also future personal situation.

Table 16

Employment action indicator and alternative measures: correlation and Granger causality*

Survey		IMCE	IPEC	UChile	CEP	Cadem
Macroaggregate action indicator: Employment						
Employment action	Country current sentiment	-	Correlation: 0.702 Granger Causality: Employment Action causes Country Sentiment	-	-	Correlation: 0.930 Granger Causality: Neither causes the other
	Personal current sentiment	Correlation: 0.680 Granger Causality: Business Situation causes Employment Action	Correlation: 0.717 Granger Causality: Employment Action causes Personal Sentiment	-	-	Correlation: 0.883 Granger Causality: Neither causes the other
	Country future expectations	Correlation: 0.507 Granger Causality: Country Expectations causes Employment Action	Correlation: 0.878 Granger Causality: Neither causes the other	-	-	-
	Personal future expectations	Correlation: 0.492 Granger Causality: Personal Expectations causes Employment Action	Correlation: 0.800 Granger Causality: Neither causes the other	-	-	-
	Overall current sentiment	-	Correlation: 0.723 Granger Causality: Employment Action causes Overall Sentiment	-	-	Correlation: 0.945 Granger Causality: Neither causes the other
	Overall future expectations	Correlation: 0.563 Granger Causality: Overall Expectations causes Employment Action	Correlation: 0.870 Granger Causality: Neither causes the other	-	-	-
	Overall country	-	Correlation: 0.907 Granger Causality: Neither causes the other	-	-	-
	Overall personal	Correlation: 0.646 Granger Causality: Overall Personal causes Employment Action	Correlation: 0.812 Granger Causality: Neither causes the other	-	-	-
	Investment action	Correlation: 0.926 Granger Causality: Employment Action causes Investment Action	Correlation: 0.787 Granger Causality: Neither causes the other	-	-	-
	Consumption action	Correlation: 0.663 Granger Causality: Consumption Expectations causes Employment Action	Correlation: 0.761 Granger Causality: Neither causes the other	-	-	Correlation: 0.882 Granger Causality: Neither causes the other

Source: Authors' calculations.

* Brown-shaded cells=variables having more than 25% of questions in common.

A major detour is observed with the construction sector. This case works in the opposite direction, in the sense that the personal and overall current situation index cause 3-month employment actions; but the latter does not cause any indicator. This last result may suggest that respondents do not believe that their future decisions will affect the overall perceived state of the economy, despite that increasing employment in the construction sector is traditionally attached to a general business cycle upswing. Notice that an important flaw of the IMCE indicator is that it actually does not elaborate on question 15 (that of 6-month-ahead investment actions) for the construction sector. Hence, this idiosyncratic result is harder to stress out with investment future decisions.

The results for investment are presented in table 18, for two sectors surveyed by IMCE with this variable in which question 15 exists (excluding mining). The results reveal similarities on the role of investment actions across the sectors. Following our results, for the case of commerce, investment decisions six months ahead are driven by the country future situation which, in turn, causes the personal situation currently and in the future. In this case, thus, it is expected that the overall current situation of the economy will result in investment actions heading to an improved personal situation at any horizon. Interestingly, the out-of-sample results of table 13 show that when using overall current and future sentiment alternative measures for gross fixed capital formation, the results are the best helping forecast accuracy. This contrasts the results for personal (current and future) alternative measures showing the worst performance. Apparently, gross fixed capital formation would help to better forecast personal alternative measures; but not the other way around.

Table 17

Granger causality analysis: Question 15 on Employment and IMCE alternative measures*

		Personal			Country	Result
		Current Sentiment Index	Personal Future Expectation Index	Overall Index	Future Expectations Index	Schematic Granger causality results
		PCSI	PFEI	OPI	CFEI	
Question 14: How will the employment in your company evolve in the next 3 months?	Commerce	Employment in 3 months causes Personal Current Sentiment Index	Both causes the other	Both cause the other	Country Future Expectations Index causes Employment in 3 months	Country/Future → Employment +3m → Personal/Current
	Manufacturing	Employment in 3 months causes Personal Current Sentiment Index	Employment in 3 months causes Personal Future Expectation Index	Both cause the other	Country Future Expectations Index causes Employment in 3 months	Country/Future → Employment +3m → Personal/Current and Future
	Construction	Personal Current Sentiment Index causes Employment in 3 months	Neither one causes the other	Overall Personal Index causes Employment in 3 months	Neither one causes the other	Personal/Overall and Current → Employment +3m

Source: Authors' calculations.

* Level of significance: 5%.

Table 18

Granger causality analysis: Question 15 on investment and IMCE alternative measures*

		Personal			Country	Result
		Current Sentiment Index	Personal Future Expectation Index	Overall Index	Future Expectations Index	Schematic Granger causality results
		PCSI	PFEI	OPI	CFEI	
Question 15: How will the investments of your company evolve in the next 6 months?	Commerce	Retail investments in 6 months causes Personal Current Sentiment Index	Retail investments in 6 months causes Personal Future Expectation Index	Both cause the other	Country Future Expectations Index causes Retail investments in 6 months	Country/Future → Investment +6m → Personal/Current and Future
	Manufacturing	Both causes the other	Industry investments in 6 months causes Personal Future Expectation Index	Both cause the other	Industry investments in 6 months causes Country Future Expectation Index	Investment +6m → Personal and Country/Current

Source: Authors' calculations.

* Level of significance: 5%.

Finally, for manufacturing, two cases of simultaneity are found (with PCSI and OPI). The remaining cases go, to a certain extent, in the same direction with respect to commerce. That is, investment actions six months ahead cause personal current situation indicator; but, this time country current situation is also caused by investment actions. In sum, 6-month investment causes all alternative measures; a fact that could be read as that industry-sector respondents believe that both personal and country situations are defined, to a considerable extent, by their own attitude towards investment decisions. This could imply that personal alternative measures may actually not be helpful when predicting investment disaggregates, a result found for the two lower panels of table 13.

Overall, and excluding the case of construction, planned hiring decisions and investment actions are caused mainly by the country future situation indicator. In turn, the intentions cause, in general, personal situation indicators at both current and future horizons.

3. Do action indicators lead actual investment, hiring, and consumption?

In this sub-section we analyze the extent to which single-question action indicators lead to actual movements in the targeted variables in a simple econometric framework. That is, if question 14, question 15, and now including consumers' question 28 (table 4), actually lead the series of total employment, investment (including its two main components), and private consumption (also including its two main components), correspondingly. Unlike the Granger causality analysis, the aim now is to answer how much time and to what extent alternative measures statistically anticipate the mentioned macroaggregates.

The analysis is thus circumscribed to estimating the following regression (l being the key parameter differing from previous analyses):

$$y_t = \alpha + \varphi \cdot y_{t-1} + \varepsilon_t - \theta \cdot \varepsilon_{t-1} - \theta_E \cdot \varepsilon_{t-4} + \theta\theta_E \cdot \varepsilon_{t-5} + \gamma_l \cdot f_{t+l}, \quad (1)$$

where y_t corresponds to a stationary transformation of the macro aggregates (*private consumption*, *non-durable consumption*, *durable consumption*, *employment*, *investment*, *machinery and equipment*, and *construction and works*), f_{t+l} is the l-step-ahead action indicator with l={1,...,8}, and ε_t is a white noise. The coefficients $\{\alpha, \varphi, \theta, \theta_E, \gamma_l\}$ are parameters to-be estimated through the *least squares method* using the Newey-West heteroskedasticity and autocorrelation correction for standard errors. Hence, the action indicator f_{t+l} leads the macroaggregate y_t in l periods if γ_l are statistically significant at traditional levels of confidence. The integer l may not necessarily be significant exactly at the question's horizon, but instead for a longer time span persistently contributing to describe the macro aggregate's dynamic. For internal coherence and to control for seasonality, the baseline specification (without augmentation) is the same used in the forecasting exercise. Also, note that the IPEC (question 28) does not distinguish between consumers, and hence, an aggregate indicator is used. For IMCE, the answers to questions 14 and 15 are weighted using the 2015 GDP weights for representativeness.

The results for *private consumption*, making use of the IPEC indicator, are reported in table 19. The upper panel displays the results for total consumption. Note that up to six quarters, the IPEC action indicator turns out to be significant, despite being 40% the size of the contemporaneous coefficient. A common element shared across consumption variables is the decline in the alternative measure's influence on the macroaggregate as the horizon l lengthens, being the contemporaneous coefficient of the greatest size.

Non-durable consumption mimics the profile described for total consumption, as it represents the larger proportion of the aggregate, and exhibiting a small variance compared to the remaining portion. These results imply that the current IPEC action indicator influences consumption dynamics. However, as a persistent and habit-based variable, the lagged coefficient (around 0.80; not shown) is still the parameter commanding the dynamic of the series.

A different outlook is found for *durable consumption*. In this case, the coefficient associated with the leading variable oscillates in terms of size and significance. Notice that, as a more volatile series, the persistence is less pronounced, and the lead coefficient achieves up to four times that of the non-durable consumption. This implies that the IPEC-based action indicator leads a greater portion of the non-durable consumption, at the cost of doing so at shorter horizons for a volatile series. This oscillating behavior, however, could be due to a number of reasons to be explored: presence of residual seasonality and the inability of the airline model to capture intra-annual movements, small sample bias, or (more likely for longer values of l) spuriousness.

Table 19

Consumption estimates augmented with IPEC action indicator (leads)*

Private consumption: Total										
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Leads	**No indicator**	***lead*=0**	***lead*=1**	***lead*=2**	***lead*=3**	***lead*=4**	***lead*=5**	***lead*=6**	***lead*=7**	***lead*=8**
IPEC (t+l)	-	**0.103****	**0.086****	**0.065****	**0.041***	**0.052****	**0.055****	**0.042***	0.024	0.035
	-	**(0.016)**	**(0.014)**	**(0.020)**	**(0.019)**	**(0.019)**	**(0.014)**	**(0.017)**	(0.020)	(0.019)
Adj. R-sq.	0.854	0.872	0.868	0.853	0.843	0.849	0.854	0.844	0.852	0.855
DW Stat.	1.854	1.947	1.971	1.893	1.930	1.930	1.940	1.863	1.895	1.881
Obs.	82	63	64	64	64	64	64	64	64	64
Private consumption: Non-durable										
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Leads	**No indicator**	***lead*=0**	***lead*=1**	***lead*=2**	***lead*=3**	***lead*=4**	***lead*=5**	***lead*=6**	***lead*=7**	***lead*=8**
IPEC (t+l)	-	**0.100****	**0.087****	**0.073****	**0.042***	**0.049****	**0.056****	**0.045****	0.004	0.010
	-	**(0.016)**	**(0.017)**	**(0.019)**	**(0.017)**	**(0.017)**	**(0.015)**	**(0.015)**	(0.018)	(0.021)
Adj. R-sq.	0.762	0.769	0.780	0.758	0.736	0.745	0.756	0.738	0.746	0.745
DW Stat.	1.996	2.010	2.059	1.918	2.005	2.004	2.020	1.927	1.996	1.997
Obs.	82	63	64	64	64	64	64	64	64	64
Private consumption: Durable										
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Leads	**No indicator**	***lead*=0**	***lead*=1**	***lead*=2**	***lead*=3**	***lead*=4**	***lead*=5**	***lead*=6**	***lead*=7**	***lead*=8**
IPEC (t+l)	-	**0.436****	**0.274****	0.203	**0.228***	**0.321****	0.134	0.101	0.188	0.270**
	-	**(0.069)**	**(0.083)**	(0.120)	**(0.112)**	**(0.079)**	(0.094)	(0.097)	(0.110)	(0.070)
Adj. R-sq.	0.867	0.885	0.862	0.858	0.865	0.881	0.861	0.859	0.867	0.878
DW Stat.	1.787	1.852	1.899	1.854	1.854	1.865	1.873	1.856	1.893	1.894
Obs.	82	63	64	64	64	64	64	64	64	64

Source: Authors' calculations.
* Sample: 2003.IV-2017.II. Coefficient standard errors in parentheses. ***: p <1%, **: p <5%, *: p <10%.

The results when using the IMCE action indicators are presented in table 20. The upper panel displays the results for *total employment*. Notice that the results are somewhat better behaved compared to durable consumption.

An oscillatory pattern for coefficient size is found, but not for statistical significance, which is consistently found up to the fifth lead. Actually, the highest lead influence occurs at $l = 1$ (instead of $l = 0$), and the second-highest coefficient is at $l = 3$, and $l = 5$ then. As figure 3 suggest, this oscillatory behavior could be due to a non-standard intra-annual pattern displayed by the employment series and not captured by the econometric specification. This is added to the previously found fact that hiring plans largely respond to the current state of the economy; thus, incorporating all short-term business cycle fluctuations.

The three lower panels of table 20 are devoted to *gross fixed capital formation*. For total investment, the results are significant for all the horizons, except l=5. In terms of size, the coefficients display an asymmetric U-shaped distribution with the contemporaneous coefficient being the highest. Notice that, similarly to total consumption, the persistence of the series is still the commanding coefficient of the series; but in this case, the leading coefficient plays a larger role compared to that of total consumption.

Table 20

Employment and investment estimates augmented with IMCE action indicators (*leads*)*

Employment										
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Leads	**No indicator**	***lead*=0**	***lead*=1**	***lead*=2**	***lead*=3**	***lead*=4**	***lead*=5**	***lead*=6**	***lead*=7**	***lead*=8**
IMCE (t+l)	-	**0.040****	**0.067****	**0.035***	**0.062****	**0.033***	**0.051***	0.028	0.042	0.018
	-	**(0.014)**	**(0.013)**	**(0.014)**	**(0.018)**	**(0.016)**	**(0.023)**	(0.021)	(0.024)	(0.020)
Adj. R-sq.	0.755	0.771	0.793	0.768	0.791	0.765	0.782	0.758	0.773	0.754
DW Stat.	2.007	1.952	1.949	2.027	1.923	2.012	1.962	2.003	1.950	1.987
Obs.	61	55	56	56	56	56	56	56	55	54
Gross fixed capital formation: Total										
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Leads	**No indicator**	***lead*=0**	***lead*=1**	***lead*=2**	***lead*=3**	***lead*=4**	***lead*=5**	***lead*=6**	***lead*=7**	***lead*=8**
IMCE (t+l)	-	**0.383****	**0.223****	**0.288****	**0.065***	**0.221****	0.100	**0.191***	**0.115***	**0.159***
	-	**(0.068)**	**(0.073)**	**(0.086)**	**(0.031)**	**(0.077)**	(0.064)	**(0.076)**	**(0.054)**	**(0.074)**
Adj. R-sq.	0.846	0.889	0.848	0.863	0.873	0.849	0.844	0.854	0.843	0.854
DW Stat.	2.014	2.042	2.109	2.146	2.046	2.114	2.128	2.147	2.078	2.036
Obs.	82	56	57	57	57	57	57	57	57	57
Gross fixed capital formation: Machinery and equipment										
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Leads	**No indicator**	***lead*=0**	***lead*=1**	***lead*=2**	***lead*=3**	***lead*=4**	***lead*=5**	***lead*=6**	***lead*=7**	***lead*=8**
IMCE (t+l)	-	**0.765****	**0.637****	**0.578***	**0.782****	**0.505****	**0.585****	**0.372***	**0.636****	**0.374***
	-	**(0.155)**	**(0.176)**	**(0.242)**	**(0.123)**	**(0.173)**	**(0.083)**	**(0.155)**	**(0.098)**	**(0.137)**
Adj. R-sq.	0.826**	0.817	0.787	0.784	0.809	0.782	0.796	0.777	0.786	0.789
DW Stat.	(0.047)	2.157	2.284	2.226	2.078	2.228	2.342	2.198	2.218	2.039
Obs.	82	56	57	57	57	57	57	57	57	57
Gross fixed capital formation: Constuction and works										
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Leads	**No indicator**	***lead*=0**	***lead*=1**	***lead*=2**	***lead*=3**	***lead*=4**	***lead*=5**	***lead*=6**	***lead*=7**	***lead*=8**
IMCE (t+l)	-	**0.192****	**0.102***	**0.146****	**0.099****	**0.090***	0.034	**0.084***	0.059	0.039
	-	**(0.035)**	**(0.043)**	**(0.031)**	**(0.036)**	**(0.039)**	(0.039)	**(0.039)**	(0.035)	(0.040)
Adj. R-sq.	0.808	0.897	0.867	0.873	0.850	0.842	0.839	0.847	0.835	0.836
DW Stat.	1.972	1.972	2.051	1.945	1.950	1.966	1.982	1.962	1.961	1.926
Obs.	82	56	57	57	57	57	57	57	57	57

Source: Authors' calculations.
* Sample: 2003.IV-2017.II. Coefficient standard errors in parentheses. ***: p <1%, **: p <5%, *: p <10%.

When disaggregating gross fixed capital formation, it becomes clear that the explanatory gains come from the *machinery and equipment* rather than the *construction and works* side. *Machinery and equipment* replicates the asymmetric U-shaped distribution of coefficient size found for the aggregate, but it does so consistently at greater coefficient levels. For *construction and works*, the lead coefficient's size is always below those of the total, but the longest significant horizon achieves a non-negligible figure at six quarters.

In sum, *non-durable consumption* and *machinery and equipment* are fairly anticipated by IPEC and IMCE action indicators at horizons comprising two years. For *durable consumption*, *construction and works*, and *employment*,

however, the action indicators show a reduced range surrounding a year; however, depicting an oscillatory evidence to be taken with greater care.

V. SUMMARY OF MAIN FINDINGS AND OPPORTUNITIES FOR FUTURE RESEARCH

Surveys of economic perceptions from business and the general public have become a standard component of macroeconomic monitoring in many countries. PMIs and other surveys are commonly examined by authorities, analysts, and the press seeking insights on the evolution of the economy. For nearly 15 years similar surveys have been applied in Chile but little attention has been paid to their ability to anticipate economic developments and/or the behavior of economic agents.

This document was aimed at assessing the quality of the data gathered by the main Chilean qualitative public opinion surveys, reviewing how they are currently built, and determining whether differently constructed alternative measures can improve the short-term forecast of macroeconomic variables (consumption, employment, and investment).

We address the shortcomings of existing synthetic indicators that mix different focuses and time perspectives. To overcome them, we assess eight alternative measures that draw from subsets of questions included in the surveys. In particular, we distinguish between *current sentiment* and *future expectations* as well as between *personal* and *country-wide* measures. In addition, we analyze action indicators, formed on the basis of questions that refer to behavior related to macroaggregates.

The results indicate that such synthetic indicators evolve with sufficient independence so as to potentially add predictive value and consistency to existing data. In particular, our results suggest that future and country-wide perceptions are formed with distinct information from personal and current sentiment, while the latter are somewhat affected by the former. In addition, for the same economic phenomena, different appraisals are obtained depending on the consulted survey. This is analyzed in terms of survey representativeness and other dimensions.

The main results for the newly proposed eight alternative measures are summarized in table 21. Granger causality results reveal the interesting insight that expectation measures cause the current sentiment measures. This implies that, when forming their expectations about the future, agents engage in some forecasting process going beyond the adaptive expectations hypothesis. The results of such forecast then influences perceptions of the current situation. Regarding personal and country-wide overall indicators, they share the common feature that no indicator Granger causes another, and both are caused by the country-wide current measure. As both overall indicators do not anticipate any other, the results suggest that these indicators tend to be formed independently at the individual level.

Table 21

Summary results for the proposed alternative measures*

	Granger caused by:	Granger cause:	Highest correlation between existing aggregate indicator and indicated measure:	Highest correlation across surveys for the indicated measure:	Same-survey correlations: Highest correlation with Current Indicators:	Same-survey correlations: Highest correlation with Future Indicators:	Predicts better (at horizon):
Personal and Country-wide Indicators							
Personal future PFEI	CFEI	CCSI, PCSI, OCSI	0.866 (IPEC)	IMCE - IPEC	**P:** 0.774 (IPEC) **C:** 0.786 (IPEC)	**P:** - **C:** 0.826 (IPEC)	Private Consumption (*h*=1)
Personal current PCSI	PFEI, CFEI, OFEI, CCSI	CCSI, OCSI	0.936 (IMCE)	IPEC - UChile	**P:** - **C:** 0.862 (IPEC)	**P:** 0.774 (IPEC) **C:** 0.715 (IMCE)	Durable Consumption (*h*=2)
Country future CFEI	-	PCSI, PFEI, OPI, CCSI, OCSI	0.850 (UChile)	UChile - CEP	**P:** 0.715 (IMCE) **C:** 0.734 (UChile)	**P:** 0.826 (IPEC) **C:** -	GFCF (*h*=3)
Country current CCSI	PCSI, PFEI, OPI	PCSI	0.931 (IPEC)	CEP - Cadem	**P:** 0.863 (Cadem) **C:** -	**P:** 0.786 (IPEC) **C:** 0.734 (UChile)	Private Consumption (*h*=4)
Overall Indicators							
Overall future OFEI	CCSI, PCSI	OCSI, CFEI	0.953 (UChile)	IPEC - UChile	**P:** 0.796 (IMCE) **C:** 0.747 (UChile)	**P:** 0.976 (IPEC) **C:** 0.969 (UChile)	GFCF (*h*=4)
Overall current OCSI	-	CCSI, PCSI	0.951 (IPEC)	CEP - Cadem	**P:** 0.918 (IPEC) **C:** 0.992 (IPEC)	**P:** 0.970 (IPEC) **C:** 0.938 (IPEC)	GFCF (*h*=3)
Overall personal OPI	CCSI	-	0.979 (IMCE)	IMCE - IPEC	**P:** 0.956 (UChile) **C:** 0.910 (UChile)	**P:** 0.995 (IPEC) **C:** 0.828 (IMCE)	Durable Consumption (*h*=4)
Overall country OCI	CCSI, OFEI	-	0.946 (IPEC)	IPEC - UChile	**P:** 0.855 (IPEC) **C:** 0.966 (CEP)	**P:** 0.918 (IPEC) **C:** 0.962 (UChile)	Private Consumption (*h*=4)

Source: Authors' calculations.

* Full balanced sample: 2003.IV-2017.II. Granger causality results and same-survey correlations consider all possible cases. "P" stands for *Personal* and "C" for *Country*. "Overall indicators" correlations not previously shown. Forecasting baseline model: *airline model* (for a comparison with versus without 4-term factor-augmentation).

Notice also that, when considering the highest correlation computations within each survey, the information contained in the proposed alternative measures actually differs between them, reflecting the different dimensions measured (and taking into account that the comparison is made with the *highest* instead of the *lowest* correlation). Finally, personal rather than country-wide sentiment measures tend to better predict household-based expenditures.

We also conduct a forecasting exercise to analyze the extent to which the newly proposed alternative measures enhance the predictive ability of the existing synthetic indicator within a general econometric framework, when forecasting investment, consumption, and employment.

Our predictive results reveal the usefulness of our proposed measures, as shown in the summary table 22. This is mostly shown for the case of total and non-durable consumption, particularly at the larger horizons considered, using the *country-wide current* and the *personal future* measure, where major and significant predictive gains are noticed. Regarding investment, predictive gains—yet non-significant—are found with the existing synthetic aggregate

indicator for total investment and its two components; a secondary role is found for the *overall* (*country* and *personal*) *current sentiment* measure when forecasting *aggregate investment* and *construction and works* at longer horizons. Hence, business surveys do not necessarily describe the investment dynamics within our general econometric framework. We also found that, in general, hiring plans and investment intentions are caused mainly by the country future situation indicator. In turn, the intentions cause, in general, personal situation indicators at both current and future horizons.

Finally, *non-durable consumption* and *machinery and equipment* are fairly anticipated by IPEC and IMCE action indicators at horizons comprising two years. For *durable consumption*, *construction and works*, and *employment*, however, the action indicators show a reduced range surrounding a year, although depicting an oscillatory evidence to be taken with greater care.

Further research could consider incorporating alternative measures in *bridge models* to nowcast/forecast macroaggregates, instead of using existing synthetic indicators. By taking advantage of the early availability of the sentiment indicators and the leading characteristic of the action indicators, a bridge regression with mixed data frequency could incorporate some of the proposed monthly indicators to forecast a quarterly variable; typically known with a time lag. This task goes beyond the exercise of Cobb et al. (2011) as now a complete set of predictive indicators is available to incorporate into the analysis. This same exercise could be performed with the *mixed data sample* (MIDAS) modelling technique introduced by Ghysels et al. (2007) in a richer economic environment.

Second, it is suggested to use the UChile and IPEC alternative measures together as instruments in a measurement-error framework to improve the forecast accuracy through efficiency corrections. That is, when using an independent variable measured with a stochastic error, ordinary least square estimates are biased and, therefore, instrumental variables are needed. This could be the case of private consumption where the proposed alternative measures naturally emerge as candidate instruments. An extension considering other household surveys' indicators and combinations with the proposed alternative measures could also contribute to deliver predictive gains through bias reduction for private consumption forecasting models.

It is also suggested to use the more sophisticated statistical methods to optimally combine alternative measures to forecast macroeconomic aggregates. In other words, make use of a blended indicator considering all relevant related alternative measures within and across surveys by using some specialized techniques to capture most of a macroaggregate dynamic (e.g. principal component). Moreover, question/survey weights may change according to the forecasting horizon at which they are targeted. The resulting factors compound a richer set of alternative variables for both testing economic theory (i.e. the employment action indicator to test Okun's Law, or consumption indicators to test the *Consumption Capital Asset Pricing Model*), and forecasting.

Table 22

Macroaggregates and economic action indicators: Granger causality, predictive, and leading quarter results

	Best predicted with:		Intentions/Plans (IMCE only) Sector:	Granger caused by:	Granger cause:	Leaded up to (quarters):	Expectations measures mostly correlated with:
1. Private consumption	*h*=1:	CFEI	-	-	-	**6** (IPEC)	**0.994** (IPEC: PFEI)
	h=2:	CCSI					
	h=3:	CCSI					
	h=4:	CCSI					
1.1. Non-durable consumption	*h*=1:	CFEI	-	-	-	**6** (IPEC)	-
	h=2:	CCSI					
	h=3:	CCSI					
	h=4:	-					
1.2. Durable consumption	*h*=1:	PFEI	-	-	-	**Oscillatory** (IPEC)	-
	h=2:	PFEI					
	h=3:	PFEI					
	h=4:	OPI					
2. Employment	*h*=1:	PCSI	**Commerce:**	CFEI	PCSI	**5** (IMCE)	**0.945** (IPEC: OCSI)
	h=2:	OCSI	**Manufacturing:**	CFEI	PCSI, PFEI		
	h=3:	OCSI	**Construction:**	PCSI, OPI	-		
	h=4:	OCSI					
2. Gross fixed capital formation	*h*=1:	-	**Commerce:**	CFEI	PFEI, PCSI	**8** (IMCE)	**0.960** (IPEC: OPI)
	h=2:	CFEI	**Manufacturing:**	-	PCSI, CCSI		
	h=3:	OCSI	**Construction:**	-	-		
	h=4:	OFEI					
2.1. Machinery and equipment	*h*=1:	CFEI	-	-	-	**8** (IMCE)	-
	h=2:	CFEI					
	h=3:	CFEI					
	h=4:	-					
2.2. Construction and works	*h*=1:	-	-	-	-	**6** (IMCE)	-
	h=2:	-					
	h=3:	OCSI					
	h=4:	OCSI					

Source: Authors' calculations.

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APPENDIX A

CONSTRUCTION OF ALTERNATIVE MEASURES

All questions are referenced according to the nomenclature of table 4.

I. NEW IMCE ALTERNATIVE MEASURES

Preliminary remarks

- All new indicators use new sectoral weights, proportional to their relative importance in the 2015 GDP (whereas the usual IMCE index uses weights based on the 2003 GDP).
- The terms "industry" and "manufacturing" are used interchangeably.
- Q16 about wages is not included in the construction of indicators as an increase in wages is not easily interpreted.

1. Country's Future Expectation Indicator: *IMCE_CFEI*

Questions asked

- Q1: How will the general economic situation of the country evolve in the next six months (commerce only)?
- Q1: How will the general economic situation of the country evolve in the next three months (construction only)?
- Q1: How will the economic activity of the country evolve in the next six months (industry and mining only)?

Calculation

The CFEI index is a weighted average of those questions, normalized to lie between 0 and 100.

$$IMCE\_CFEI_t = w_1 \mathrm{Q1}t_t + w_2 \mathrm{Q1}c_t + w_3 \mathrm{Q1}i_t + w_4 \mathrm{Q1}m_t, \quad \text{(A1)}$$

where w_1, w_2, w_3, and w_4, are the 2015 weights for commerce, construction, industry, and mining, respectively, and the letters t, c, I, and m after the question number refer to the sectors.

2. Overall Personal Indicator: *IMCE_OPI*

Questions asked

- Q2: How is the current state of your business (all sectors)?
- Q8: How will the state of your business evolve in the next six months (all sectors except construction)?
- Q12: How will your financial situation evolve in the next six months (commerce only)?

- Q12: How will your financial situation evolve in the next three months (construction only)?
- Q13: How will your production evolve in the next three months (industry and mining only)?
- Q3: How is the state of your inventory (all sectors except construction)?
- Q5: How is the demand faced by your business (construction only)?

Calculation
The OPI index is a weighted average of those questions, normalized to lie between 0 and 100.

$$IMCE\_OPI_t = w_1 \frac{Q2t_t + Q8t_t + Q12t_t - Q3t_t}{4} + w_2 \frac{Q2c_t + Q5c_t + Q12c_t}{3} + w_3 \frac{Q2i_t + Q8i_t + Q13i_t - Q3i_t}{4} + w_4 \frac{Q2m_t + Q8m_t + Q13m_t - Q3m_t}{4}. \quad (2A)$$

3. Overall Current Sentiment Indicator: *IMCE_OCSI*

Questions asked
- Q2: How is the current state of your business?
- Q3: How is the state of your inventory? (except construction)
- Q4: How did your sales evolve compared to last month? (commerce, industry, and mining)
- Q4: How did the activity of your company evolve in the past three months? (construction)
- Q5: How is the demand faced by your business currently? (construction and mining)
- Q6: How has the production of your company evolved compared to last month? (industry)

Calculation
The CSI is a weighted average of these questions.

$$IMCE\_OCSI_t = w_1 \frac{Q2t_t - Q3t_t + Q4t_t}{3} + w_2 \frac{Q2c_t + Q4c_t + Q5c_t}{3} + w_3 \frac{Q2i_t - Q3i_t + Q4i_t + Q6i_t}{4} + w_4 \frac{Q2m_t - Q3m_t + Q4m_t + Q5m_t}{4}. \quad (3A)$$

4. Overall Future Expectation Indicator: *IMCE_OFEI*

Questions asked

- Q1: How will the general economic situation of the country evolve in the next six months (commerce)?
- Q1: How will the general economic situation of the country evolve in the next three months (construction)?
- Q1: How will the economic activity of the country evolve in the next six months (industry and mining)?
- Q8: How will the state of your business evolve in the next six months?
- Q9: How will your sales evolve in the next three months? (commerce)
- Q13: How will your production evolve in the next three months? (industry and mining)
- Q14: How will the employment in your company evolve in the next three months (construction)?
- Q12: How will your financial situation evolve in the next three months (construction)?
- Q12: How will your financial situation evolve in the next six months (commerce)?

Calculation

The OFEI is a weighted average of these questions.

$$IMCE\_OFEI_t = w_1 \frac{Q1t_t + Q8t_t + Q9t_t + Q12t_t}{4} + w_2 \frac{Q1c_t + Q12c_t + Q14c_t}{3} + w_3 \frac{Q1i_t + Q8i_t + Q13i_t}{3} + w_4 \frac{Q1m_t + Q8m_t + Q13m_t}{3}. \quad (4A)$$

5. Personal Current Sentiment Indicator: *IMCE_PCSI*

Questions asked

- Q2: How is the current state of your business?
- Q3: How is the state of your inventory? (except construction)
- Q4: How did your sales evolve compared to last month? (commerce, industry, and mining)
- Q4: How did the activity of your company evolve in the past three months? (construction)
- Q5: How is the demand faced by your business currently? (construction and mining)
- Q6: How has the production of your company evolved compared to last month? (industry and mining)

Calculation

$$IMCE\_PCSI_t = w_1 \frac{Q2t_t - Q3t_t + Q4t_t}{3} + w_2 \frac{Q2c_t + Q4c_t + Q5c_t}{3} + w_3 \frac{Q2i_t - Q3i_t + Q4i_t + Q6i_t}{4} + w_4 \frac{Q2m_t - Q3m_t + Q4m_t + Q5m_t + Q6m_t}{5}. \quad (5A)$$

6. Personal Future Expectation Indicator: *IMCE_PFEI*

Questions asked

- Q8: How will the state of your business evolve in the next six months? (except construction)
- Q9: How will your sales evolve in the next three months? (commerce only)
- Q10: How will the price of your inputs change in the next three months?
- Q11: How will the price of your sales change in the next three months?
- Q12: How will your financial situation evolve in the next six months (commerce)?
- Q12: How will your financial situation evolve in the next three months (construction)?
- Q13: How will your production evolve in the next three months (industry and mining)?

Calculation

$$IMCE\_PFEI_t = w_1 \frac{Q8t_t + Q9t_t - Q10t_t + Q11t_t + Q12t_t}{5} + w_3 \frac{Q11c_t - Q10c_t + Q8c_t + Q13c_t}{4} + w_2 \frac{Q11c_t - Q10c_t + Q12c_t}{3} + w_4 \frac{Q11m_t - Q10m_t + Q8m_t + Q13m_t}{4}. \quad (6A)$$

7. Country's Current Sentiment Indicator: *IMCE_CCSI*

- No questions available

8. Overall Country Indicator: *IMCE_OCI*

- No questions available

II. NEW IPEC ALTERNATIVE MEASURES

Preliminary remarks

- Questions about saving (Q25 and Q29) are not used in constructing the indicators because an increase in savings has different possible economic causes.
- Question about long-term country situation (Q22) is not used as it is a forecast too far into the future.
- The indicator is a simple average of the balance statistics of the above questions.

1. Country's Current Sentiment Indicator: *IPEC_CCSI*

Questions asked
- Q17: How is the current situation of the country?
- Q18: What is the current situation of businesses?

2. Country's Future Expectation Indicator: *IPEC_CFEI*

Questions asked
- Q20: What will be the economic situation of the country in 12 months?
- Q23: How will the level of unemployment will evolve in the next 12 months?
- Q24: By how much will the prices change in the next 12 months? (a lot, a bit)

Remark
The 5-year horizon is too long for our purposes. In addition, the literature shows that there is no additional predictive power for such variable. Question about saving is ambiguous.

3. Personal Current Sentiment Indicator: *IPEC_PCSI*

Question asked
- Q26: How does the economic situation of your household compare to one year ago?

4. Personal Future Expectation Indicator: *IPEC_PFEI*

Questions asked
- Q28: How will the economic situation of your household evolve in the next year?
- Q30: Is this a good time to buy a property?
- Q32: Is this a good time to buy large items?
- Q31: Is this a good time to buy a car?

5. Overall Future Expectation Indicator: *IPEC_OFEI*

Questions asked
- Q20: What will be the economic situation of the country in 12 months?
- Q23: How will the level of unemployment evolve in the next 12 months?
- Q24: By how much will the prices change in the next 12 months? (a lot, a bit)
- Q28: How will the economic situation of your household evolve in the next year?
- Q30: Is this a good time to buy a property?
- Q32: Is this a good time to buy large items?
- Q31: Is this a good time to buy a car?

6. Overall Current Sentiment Indicator: *IPEC_OCSI*

Questions asked
- Q17: How is the current situation of the country?
- Q18: What is the current situation of businesses?
- Q26: How does the economic situation of your household compare to one year ago?

7. Overall Personal Indicator: *IPEC_OPI*

Questions asked
- Q26: How does the economic situation of your household compare to one year ago?
- Q28: How will the economic situation of your household evolve in the next year?
- Q30: Is this a good time to buy a property?
- Q32: Is this a good time to buy large items?
- Q31: Is this a good time to buy a car?

8. Overall Country Indicator: *IPEC_OCI*

Questions asked
- Q17: How is the current situation of the country?
- Q18: What is the current situation of businesses?
- Q20: What will be the economic situation of the country in 12 months?
- Q23: How will the level of unemployment evolve in the next 12 months?
- Q24: By how much will the prices change in the next 12 months?

III. NEW UCHILE ALTERNATIVE MEASURES

Preliminary remarks
- Previous data on expected CPI inflation is missing (was asked from June 2005 onwards).
- The quarterly data used dates back to March 2003, whereas UChile data on their website dates back to 1997.
- Q39 "What are the three main problems of the country?" will not be used for obvious reasons.
- UChile uses extensively its data so there are not many new indices to create.
- The indicator is a simple average of the balance statistics of the mentioned questions.
- The *Overall Personal*, *Overall Country*, *Overall Future Expectations* and *Overall Current Sentiment* indicators are already constructed and reported by UChile. They are labeled "Family situation," "Country situation," "Expected situation," and "Current situation," respectively.

1. Country's Current Sentiment Indicator: *UChile_CCSI*

Question asked

- Q38: How was the economic situation of the country a year ago?

2. Country's Future Expectation Indicator: *UChile_CFEI*

Question asked

- Q40: In one year, how will be the economic situation of the country compared to today?

3. Personal Current Sentiment Indicator: *UChile_PCSI*

Questions asked

- Q41: How did the income of your household vary within the last 12 months?
- Q42: How is the situation of your household in terms of indebtedness?
- Q45: Did a member of your household buy a durable good in the past three months?

4. Personal Future Expectation Indicator: *UChile_PFEI*

Questions asked

- Q43: How will the income of your household vary within the next 12 months?
- Q46: Will a member of your household buy a durable good in the next three months?
- Q47: Are you or is a member of your household thinking of buying a house in the next 12 months?

IV. NEW CEP ALTERNATIVE INDICATORS

Preliminary remark

- The indicator is a simple average of the balance statistics of the mentioned questions.

1. Country's Future Expectation Indicator: *CEP_CFEI*

Question asked

- Q35: How will the economic situation of the country evolve in the next 12 months?

2. Personal Future Expectation Indicator: *CEP_PFEI*

Question asked

- Q37: In one year, how do you think your economic situation will be compared to today?

3. Current Country Sentiment Indicator: *CEP_CCSI*

Questions asked
- Q33: How is the current economic situation of the country?
- Q34: Do you think Chile is progressing, stagnating, or in decline?

4. Personal Current Sentiment Indicator: *CEP_PCSI*

Question asked
- Q36: How do you qualify your current economic situation?

5. Overall Future Expectation Indicator: *CEP_OFEI*

Questions asked
- Q35: How will the economic situation of the country evolve in the next 12 months?
- Q37: In one year, how do you think your economic situation will be compared to today?

6. Overall Current Sentiment Indicator: *CEP_OCSI*

Questions asked
Q33: How is the current economic situation of the country?
Q34: Do you think Chile is progressing, stagnating, or in decline?
Q36: How do you qualify your current economic situation?

7. Overall Country Indicator: *CEP_OCI*

Questions asked
Q33: How is the current economic situation of the country?
Q34: Do you think Chile is progressing, stagnating, or in decline?
Q35: How will the economic situation of the country evolve in the next 12 months?

8. Overall Personal Indicator: *CEP_OPI*

Questions asked
- Q36: How do you qualify your current economic situation?
- Q37: In one year, how do you think your economic situation will be compared to today?

V. NEW CADEM ALTERNATIVE INDICATORS

Preliminary remarks
- Cadem has no current aggregate indicator: it reports the balance statistic for each question.

- Two questions out of seven are non-useable to construct economic indicators as they encompass economic, social and political issues.
- The indicator is a simple average of the balance statistics of the mentioned questions.

1. Current Country Sentiment Indicator: *Cadem_CCSI*

Questions asked

- Q49: Do you think that the Chilean economy is progressing, stagnating or declining?
- Q50: How would you rate the current economic situation of businesses?
- Q51: How would you rate the current situation of employment in the country?

2. Personal Current Sentiment Indicator: *Cadem_PCSI*

Questions asked

- Q53: How would you rate the current economic situation of you and your household?
- Q54: How would you rate the economic situation of consumers to purchase goods and services?

3. Overall Current Sentiment Indicator: *Cadem_OCSI*

Questions asked

- Q49: Do you think that the Chilean economy is progressing, stagnating, or declining?
- Q50: How would you rate the current economic situation of businesses?
- Q51: How would you rate the current situation of employment in the country?
- Q53: How would you rate the current economic situation of yourself and your household?
- Q54: How would you rate the economic situation of consumers to purchase goods and services?

4. Country's Future Expectation Indicator: *Cadem_CFEI*

- No questions available

5. Personal Future Expectation Indicator: *Cadem_PFEI*

- No questions available

6. Overall Future Expectation Indicator: *Cadem_OFEI*

- No questions available

7. Overall Country Indicator: *Cadem_OCI*

- No questions available

8. Overall Personal Indicator: *Cadem_OPI*

- No questions available

APPENDIX B

FORECASTING EXERCISE

The forecasting exercise is conducted as follows. First, we consider the two main components of domestic demand which are targeted by the IMCE and IPEC surveys: private consumption (*pc*) and investment (*i*). At the same time, we consider the two components of private consumption: *non-durable* (*ndc*) and *durable* (*dc*) consumption. Then the same is done for investment (gross fixed capital formation), compounded by *machinery and equipment* (*meq*) and *construction and works* (*cw*). Finally, as IMCE deals with entrepreneurs' plans, for both investment and hiring, we also consider total employment (*emp*) as predicted by the IMCE and its alternative measures. All these six series (*pc*, *ndc*, *dc*, *i*, *meq*, and *cw*) are transformed into annual percentage changes to achieve stationarity (and depicted in figure 3).

Second, by using the sample covered from 2003.IV to 2014.II (43 observations in quarterly frequency), we estimate a version of the so-called *airline model* (Box and Jenkins, 1970) for each of the seven variables, which makes use of the information exclusively contained in the same series, including a four-term exogenous factor augmentation. The baseline specification thus is:

$$y_t = \alpha + \psi(L) f_t + \phi y_{t-1} + \varepsilon_t - \theta\varepsilon_{t-1} - \theta_E\varepsilon_{t-4} + \theta\theta_E\varepsilon_{t-5}, \qquad (1B)$$

where $\{\alpha, \phi, \theta_E, \psi_l,\}$ are to-be-estimated parameters, f_t corresponds to IMCE or IPEC *existing* or *alternative measures*, and is a white noise. Notice that the polynomial $\psi(L)$—where L is a lag operator, —is a four-term coefficient set with L=3. In other words, the alternative measures are included contemporaneously plus three lags, completing a year of information. This is possible because data availability of surveys are four to five months prior to macroeconomic aggregates. Obviously, y_t could be {*pc*, *ndc*, *dc*, *emp*, *i*, *meq*, *cw*}, and f_t the list of options in table 6 depicted in figure 1 (without any kind of transformation).[11] The use of this general econometric specification obeys to the arguments given in Ghysels et al. (2006), as the Box-Jenkins *airline model* comes out as a suitable representation of the majority of seasonal macroeconomic series.

11 Notice that in just a few occasions the F-test rejects that the coefficients of the exogenous factor are jointly equal to zero. By considering the evaluation sample for each case, this account is: Private Consumption: Total (1: CCSI; 2: PFEI; 1: OCSI; 6: OPI); Employment (1: PCSI, 1: OCSI); Gross Fixed Capital Formation: Total (3: PFEI); Gross Fixed Capital Formation: Machinery and equipment (1: PFEI); and Gross Fixed Capital Formation: Construction and works (2: CFEI; 2: PFEI). These numbers indicate the number of times in which the exogenous factor is not statistically significant out of a total of 12 observations.

These results complement those of Pincheira (2014), in which original IMCE sectorial indicators are used to help forecast sectorial employment. Traditional *Adjusted* R^2 statistic is used as an in-sample goodness-of-fit measure. Notice that Albagli and Luttini (2015) analyze the in-sample role of IMCE included in a VAR model (including investment fundamentals) also finding an in-sample role for the existing overall indicator.

Third, we make use of the remaining sample available, from 2014.III to 2017.II (12 observations in quarterly frequency) as the evaluation sample for one- to four-step-ahead forecasts. The forecast evaluation statistic used is the root mean squared forecast error (RMSFE) defined as:

$$RMSFE_h = \left[\frac{1}{P(h)} \sum_{t=R}^{T+1-h} \left(y_{t+h} - \hat{y}_{t+h|t} \right)^2 \right]^{\frac{1}{2}}, \tag{2B}$$

where $\hat{y}_{t+h|t}$ represents the forecast of y_{t+h} made with information known up until time t. We generate a total of $P(h)$ forecasts, satisfying $P(h) = T + 2 - h - R$, where h is the forecast horizon, $h = \{1,2,3,4\}$, and R is the number of observations in the estimation sample.

Finally, most of the results are reported using the *Relative RMSFE* coefficient to ease a comparison across the alternative measures. The *Relative RMSFE* is computed as follows:

$$Relative\ RMSFE_h = \frac{RMSFE_h\left(Sub-indicator\right)}{RMSFE_h\left(Existing\,indicator\right)}, \tag{3B}$$

isolating the forecasting gain due to the alternative measure beyond that already provided by the existing indicator. Figures lower than one imply a better performance of the alternative measure relative to the existing aggregate indicator. For these comparisons, where the baseline specification is the same for both components, the Harvey et al. (1997) test is used.

Similarly, for the case where no factor is used, the following *Relative RMSFE* is used:

$$Relative\ RMSFE_h = \frac{RMSFE_h\left(Existing\,indicator\right)}{RMSFE_h\left(No\,indicator\right)}. \tag{4B}$$

Hence, figures lower than one imply a better performance of the existing indicator relative to the no-indicator case.

APPENDIX C

FORECAST EVALUATION FRAMEWORK

As above-mentioned, we evaluate the predictive ability of the proposed alternative measures in two dimensions. The first consists in comparing the information that the alternative measure forecast provides beyond that of the existing indicator, whereas the second compares the alternative measure forecast with a version with no any augmentation. For the former case, the Harvey, Leybourne, and Newbold (1997; HLN) test of equal predictive ability is used, which consists in a small-sample-corrected version of the Diebold and Mariano (1995) test. For the latter case, the Clark and West (2007; CW) test is used because it consists of an adjusted root mean squared forecast error (RMSFE) comparison due to model encompassing. Also, with the HLN test we plainly evaluate *forecast accuracy* and not *model adequacy*, whereas the CW test evaluates the opposite: model adequacy instead of forecast accuracy. Notice that the CW is not appropriate for small sample environments due to a reduction of its power. However, no similar correction to the HLN for the Diebold-Mariano has been proposed. Thus, we use it as good as it gets of a better alternative.

The CW test can be considered as both an encompassing test or an adjusted comparison of the MSFE. The adjustment is made to make a fair comparison between nested models. Intuitively, the CW test removes a term that introduces noise when a parameter, that should be zero under the null hypothesis of equal MSFE, is estimated.

The core statistic of the CW test is constructed as follows:

$$\hat{z}_{t+h} = \left(\hat{e}_{1,t+h}\right)^2 - \left[\left(\hat{e}_{2,t+h}\right)^2 - \left(\hat{y}_{1,t+h|t} - \hat{y}_{2,t+h|t}\right)^2\right], \tag{1C}$$

where

$$\hat{e}_{1,t+h} = y_{t+h} - \hat{y}_{1,t+h|t}, \tag{2C}$$
$$\hat{e}_{2,t+h} = y_{t+h} - \hat{y}_{2,t+h|t},$$

represent the corresponding forecast errors. Notice that $\hat{y}_{1,t+h|t}$ and $\hat{y}_{2,t+h|t}$ denote the h-step-ahead forecasts generated from two models under consideration. "Model 1" is the parsimonious or *small* model without indicator-augmentation that is nested in the *larger* "Model 2". In other words, Model 2 would become Model 1 if some of its parameters were set to zero.

With a little algebra, it is straightforward to show that could also be expressed as follows:

$$Sample\,MSFE-Adjusted=\frac{2}{P(h)}\sum_{t=R}^{T+1-h}\hat{e}_{1,t+h}\left(\hat{e}_{1,t+h}-\hat{e}_{2,t+h}\right). \tag{3C}$$

This statistic is used to test the following null hypothesis, against the alternative:

$$\begin{aligned} H_0 &: \mathbb{E}\left[Sample\,MSFE-Adjusted\right]=0, \\ H_1 &: \mathbb{E}\left[Sample\,MSFE-Adjusted\right]>0. \end{aligned} \tag{4C}$$

The CW test suggests a one-sided test for a *t*-type statistic based upon the core statistic in (C1), i.e. asymptotically normal critical values. In most of the CW analysis, it follows Clark and McCracken (2001, 2005). Theoretical results in those papers require the models to be estimated with *nonlinear least squares*, which we use in this article, and also that multistep forecasts be made with the direct method. As we make use of the iterated forecast method, we show the results at more than one-step-ahead horizon just for reference.

Secondly, we focus in the HLN test of equal predictive ability. We do so given our concern for evaluating forecast accuracy instead of model adequacy in a small sample environment. According to the Diebold-Mariano original test, we focus on testing the following null hypothesis against the alternative:

$$\begin{aligned} H_0 &: \mathbb{E}\left[\hat{d}_{t(h)}\right]=0, \\ H_1 &: \mathbb{E}\left[\hat{d}_{t(h)}\right]\neq 0, \end{aligned} \tag{5C}$$

where

$$\hat{d}_{t(h)}=\left(y_{t+h}-\hat{y}_{1,t+h|t}\right)^2-\left(y_{t+h}-\hat{y}_{2,t+h|t}\right)^2. \tag{6C}$$

Our null hypothesis posits that forecasts generated from the nested model perform equally to those generated from the larger model. As noted by HLN, using an approximately unbiased estimator of the variance of the mean of leads to a modified Diebold-Mariano test statistic:

$$HLN_{(h)}=\left[\frac{n+1-2h+n^{-1}h(h-1)}{n}\right]^{\frac{1}{2}}\left(\bar{d}_{(h)}/\hat{\sigma}_{d(h)}\right), \tag{7C}$$

which must be contrasted with critical values from a Student's *t* distribution with (n–1) degrees of freedom. It is important to emphasize that the two tests differ in a number of aspects. One of the most important differences, is that they are designed for different purposes. Consequently, we expect these two tests to deliver different results. Most likely, the CW test will be able to show more rejections of the null hypothesis than the HLN test.

APPENDIX D

CONSTRUCTION OF ACTION INDICATORS

All questions are referenced according to the nomenclature of table 4.

I. NEW IMCE ACTION INDICATORS

1. Investment Action Indicator: *IMCE_InvAI*

Remark
It aims at capturing the (qualitative) investment expectations of businesses. Given that the National Accounts' definition of investment is the sum of "construction and other investment works" and "machinery and equipment," we use questions reflecting the health of the construction sector in general. Surprisingly, there is no question about construction's expected production or state of the business.

Questions asked
- Q15: How will the investments of your company evolve in the next six months (all sectors except construction)?
- Q5: How is the demand faced by your business (construction only)?
- Q2: How is the current state of your business (construction only)?
- Q12: How will the financial situation of your business evolve in the next three months (construction only)?
- Q14: How will the employment in your company evolve in the next three months (construction only)?

Calculation
The *InvAI* is a weighted average of those questions, normalized to lie between 0 and 100.

$$IMCE\_InvAI_t = w_1 \mathrm{Q15}t_t + w_2 \frac{\mathrm{Q5}c_t + \mathrm{Q2}c_t + \mathrm{Q12}c_t + \mathrm{Q14}c_t}{4} + w_3 \mathrm{Q15}i_t + w_4 \mathrm{Q15}m_t. \quad (1D)$$

2. Consumption Action Indicator: *IMCE_CAI*

Remark
It aims at capturing the future evolution of consumption, given businesses' expectations. Assuming that the mining sector's production is bought only by companies, it is not used in generating this index. For the construction sector, we also have no data on the respective share of final and intermediate consumption in the added value. It is only possible to find the share of land built for households and businesses (*INE.cl > Inicio > Laborales > Edificación:*

Superficie Autorizada). In 2015, roughly 70% (69.68%) of the surface built was for households, so we will weight by 70%. We thus assume that the average price of office space is the same as the average price of housing.

Questions asked

- Q9: How will your sales evolve in the next three months (commerce only)?
- Q13: How will your production evolve in the next three months (industry only)?
- Q12: How will your financial situation evolve in the next three months (construction only)?
- Q5: How is the demand faced by your business (construction only)?
- Q4: How have your sales evolved compared to last month (commerce and industry)?
- Q4: How has the activity of your company evolved in the past three months (construction only)?

Calculation

The CAI is a (differently) weighted average of those questions, normalized to lie between 0 and 100.

$$IMCE\_CAI_t = \left[\frac{w_1}{w_1+w_2+w_3}\right]\times\frac{\text{Q9}t_t+\text{Q4}t_t}{2}+\left[\frac{w_2}{w_1+w_2+w_3}\right]\times\frac{\text{Q12}c_t+\text{Q5}c_t}{2} + \left[\frac{w_3}{w_1+w_2+w_3}\right]\times\frac{\text{Q13}i_t+\text{Q4}i_t}{2}. \quad (2D)$$

3. Employment Action Indicator: *IMCE_EAI*

Remark

Even though the wage level affects employment negatively, we can assume that businesses take this into account when answering questions about employment, so questions about wages are not used. Surprisingly, there is no information available for wage level in the commerce sector.

Question asked

- Q14: How will the employment in your company evolve in the next three months (all sectors)?

Calculation

The EAI is a weighted average of this question.

$$IMCE\_EAI_t = w_1\text{Q14}t_t + w_2\text{Q14}c_t + w_3\text{Q14}i_t + w_4\text{Q14}m_t \ . \quad (3D)$$

II. NEW IPEC ACTION INDICATORS

1. Investment Action Indicator: *IPEC_InvAI*

Questions asked
- Q30: Is this a good time to buy a property?
- Q18: What is the current situation of businesses?

2. Employment Action Indicator: *IPEC_EAI*

Question asked
- Q23: How will the level of unemployment evolve in the next 12 months?

Remark
Even if it asks about unemployment, it is still usable: only the sign will change in correlations or regressions.

3. Consumption Action Indicator: *IPEC_CAI*

Questions asked
- Q30: Is this a good time to buy a property?
- Q31: Is this a good time to buy a car?
- Q32: Is this a good time to buy large items?

III. NEW UCHILE ACTION INDICATORS

1. Consumption Action Indicator: *UChile_CAI*

Questions asked
- Q42: How is the situation of your household in term of indebtedness?
- Q43: How will the income of your household vary within the next 12 months?
- Q45: Did a member of your household buy a durable good in the past three months?
- Q46: Will a member of your household buy a durable good in the next three months?
- Q47: Are you or a member of your household thinking of buying a house in the next 12 months?

2. Investment Action Indicator: *UChile_InvAI*

- No qualitative question available.

3. Employment Action Indicator: *UChile_EAI*

- No qualitative question available.

IV. NEW CEP ACTION INDICATORS

1. Consumption Action Indicator: *CEP_CAI*

- No questions available

2. Investment Expectation Indicator: *CEP_InvAI*

- No questions available

3. Employment Expectation Indicator: *CEP_EAI*

- No questions available

V. NEW CADEM ACTION INDICATORS

1. Employment Action Indicator: *Cadem_EAI*

Question asked

- Q51: How would you rate the current situation of employment in the country?

2. Investment Action Indicator: *Cadem_InvAI*

No questions available

3. Consumption Action Indicator: *Cadem_CAI*

Questions asked

- Q54: How would you rate the economic situation of consumers to purchase goods and services?